DRY TORTUGAS NATIONAL PARK

DRTO

NATIONAL PARK SERVICE
WATER RESOURCES DIVISION
FORT COLLINS, COLORADO
RESOURCE ROOM PROPERTY

DRAFT GENERAL MANAGEMENT PLAN AMENDMENT
ENVIRONMENTAL IMPACT STATEMENT

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NATIONAL PARK SERVICE
WATER RESOURCES DIVISION
FORT COLLINS, COLORADO
RESOURCE ROOM PROPERTY

Draft
General Management Plan Amendment
Environmental Impact Statement

Dry Tortugas
National Park
Monroe County, Florida

The purpose of this *Draft General Management Plan Amendment / Environmental Impact Statement* for Dry Tortugas National Park in Monroe County, Florida, is to set forth the management philosophy and management direction for the park for the next 15 to 20 years. The park has been operating under the *General Management Plan / Development Concept Plan / Environmental Assessment* that was prepared in 1983. Although much of the 1983 plan is still applicable, this older plan does not address several current issues. The 1983 plan needs amending to provide overall guidance for the future use of resources and facilities; to clarify research and resource management needs, priorities, and strategies; and to address changing levels of park visitation and use. When completed, this new *General Management Plan Amendment* will replace the 1983 plan. Specific issues to be addressed in this amendment include protection of near-pristine resources such as coral reefs and sea grass beds, the protection of submerged cultural resources, the management direction of commercial services to provide transportation and assistance in educating visitors, and the determination of appropriate levels and types of visitor use. Establishing appropriate levels of visitor use is especially important. In 1984 the park had 18,000 visitors Last year more than 84,000 people visited the park. The first quarter visitation numbers of 2000 are 25% greater than last year. Managers must take actions to deal with visitor safety and enjoyment as well as protect the resources.

This *Draft General Management Plan Amendment* presents and analyzes five alternative future directions for management and use of Dry Tortugas National Park. Alternative A, a "no-action" alternative, presents what would happen under a continuation of existing conditions, without a new management plan, and provides a basis for comparing the other alternatives. Alternatives B, C, D, and E (the "action alternatives") considered in this document provide different ways to meet current and future needs, protect park resources, and enhance visitor experience. Alternative B provides greater protection of natural and cultural resources than alternative A. Alternative C, which has been identified as the National Park Service's proposed action/preferred future direction, affords a high level of protection to significant park resources through selectively applying a research natural area zone, instituting a permit system for private boaters, and using commercial services to direct and structure visitor use. Alternative D is the same as alternative C except that the research natural area zone is larger and private boaters would not be allowed in this zone. Alternative E is the same as alternative D except that the research natural area zone would be applied to almost the entire park. The potential consequences and environmental impacts associated with implementing each of the alternatives are evaluated in the "Environmental Consequences" section of this document.

Concurrent with the completion of the *General Management Plan Amendment*, the National Park Service will issue a "Notice of Proposed Rule Making." This will initiate the process of establishing new or revised regulations that are directed by the final plan. Public comments received on the *Draft General Management Plan Amendment* that address topics that will be the subject of rulemaking will also apply to public review of the draft regulations when they are released for public comment.

This *Draft General Management Plan Amendment* has been distributed to other agencies and interested individuals for their review and comment. The public comment period for this environmental impact statement will last for 60 days and end August 1, 2000. Readers are encouraged to send written comments on the *Draft General Management Plan Amendment / Environmental Impact Statement* to Superintendent, Everglades and Dry Tortugas National Parks, 40001 State Road 9336, Homestead, FL 33034-6733 or email comments to DRTO_planning@nps.gov. Please note that NPS practice is to make comments, including names and addresses of respondents, available for public review if requested (see "Summary" section).

U.S. Department of the Interior • National Park Service

SUMMARY

The Florida Keys are composed of 1,700 keys or islands, all of which are in Monroe County. Dry Tortugas National Park is the westernmost part of the Florida Keys and is about 70 miles west of Key West, Florida, in the Straits of Florida. The park contains seven keys and is administered by the National Park Service. Only two of the keys in the 100-square-mile national park are inhabited. The keys in the park are composed of coral reefs and sand and the surrounding shoals and water. Totaling 104 acres, the islands in the park are situated on the edge of the main shipping channel between the Gulf of Mexico, the western Caribbean, and the Atlantic Ocean. The islands and reefs pose a serious navigation hazard to ships passing through the 75-mile-wide straits between the gulf and the ocean and have been the site of hundreds of shipwrecks, which still occasionally occur in the area. The shipwrecks on the reefs comprise one of the nation's principal ship graveyards.

Fort Jefferson, on Garden Key, is the park's central cultural feature and is the largest 19th century American coastal fort. Construction began on the structure in 1846, but the fort was never completed. Originally built to protect shipping access to the gulf, the fort was used as a military prison during the Civil War. Today, the fort is the primary destination for people visiting the park. Loggerhead Key is the largest key and contains a brick tower lighthouse that was completed in 1858 that is still operable. The lighthouse was manned by Coast Guard personnel until recently when it was turned over to the National Park Service. The remaining keys are Bush, Long, East, Hospital, and Middle. Because they are turtle and bird nesting sites, Hospital and Long Keys are closed to visitors all year; Bush Key is closed part of the year during bird nesting season. Middle Key is a sandbar that is awash in the summer but emerges intermittently at other times of the year.

The Dry Tortugas are recognized for their near-pristine natural resources including sea grass beds, fisheries, and sea turtle and bird nesting habitat. In addition, the tropical coral reef of the Tortugas is one of the best developed on the continent and possesses a full range of Caribbean coral species, some of which are rare elsewhere. These resources play a vital role in South Florida's efforts to attain a balanced and sustainable ecosystem. For example, the park's protected spawning habitat produces larger apex predators (predators at the top of the food chain) and rich biodiversity of species such as reef fish, lobster, and shrimp. Movement and flow of currents in the keys disperse larva to distant areas, resulting in benefits to regional fisheries and therefore to recreational and commercial fishermen and research scientists beyond the park.

Every unit in the national park system is required to operate under a management plan that sets the direction for future management of each specific unit. Dry Tortugas National Park has been operating under the 1983 *General Management Plan / Development Concept Plan / Environmental Assessment* (NPS 1983b). Although much of the 1983 plan still applies, it needs amending to address current issues; to provide overall guidance for the future use of resources and facilities; to clarify research and resource management needs, priorities, and strategies; and to address changing levels of park visitation and use. When completed, this new *General Management Plan Amendment* will replace the 1983 plan.

Specific issues to be addressed in this amendment include protection of near-pristine resources such as coral reefs and sea grass beds, the protection of submerged cultural resources, the management direction of commercial services to provide transportation and assistance in educating visitors, and the determination of appropriate levels and types of visitor use. Visitation at

the park has risen from 18,000 visitors in 1984 to 84,000 in 2000. The first quarter visitation numbers of 2000 are already 25% greater than last year.

Five alternative future directions for management and use of Dry Tortugas National Park are analyzed in this draft document. Alternative A, a "no-action" alternative, presents what would happen under a continuation of existing conditions, without an amended management plan, and provides a basis for comparing the other alternatives. Alternatives B, C, D, and E (the "action alternatives") considered in this document provide different ways to meet current and future needs, protect park resources, and enhance visitor experience.

Alternative B provides greater protection of the natural and cultural resources than alternative A. Under alternative B the types and levels of visitor use would be managed to protect resources and the quality of the visitor experiences. Where critical resource degradation was observed, park staff would direct intensive protection and/or remediation measures to abate impacts. Visitors would be free to travel and experience a variety of recreational opportunities throughout much of the park.

Alternative C has been identified as the National Park Service's proposed action/ preferred future direction. The intent under alternative C is to afford a high level of protection to significant park resources through the selective application of a research natural area zone, instituting a permit system for private boaters, and using commercial services to direct and structure visitor use. A wide range of recreational and educational opportunities would be available to visitors provided that appropriate resource conditions were maintained. Visitor experience would be enhanced due to expanded access throughout the park and higher-quality resources to enjoy. The goal for commercial service operations would be to be self-contained, thus reducing the strain on the limited park facilities. The types and levels of visitor use would be managed to protect resources and the quality of the visitor experiences.

The concept under alternative D is exactly the same as alternative C except that (1) the research natural area zone boundaries would be slightly different (still compatible with the Florida Keys National Marine Sanctuary's preferred alternative for establishing ecological reserves in the Tortugas area), and (2) private boaters would not be allowed to anchor or tie up to a mooring buoy for diving, snorkeling, etc. in the research natural area. Private boaters would be allowed to transit through the research natural area.

Under alternative E, most of the park would be designated as a research natural area and managed accordingly, with primary emphasis on resource protection and conservation. The alternative recognizes the paramount importance of preserving the park's near-pristine and fragile ecological resources and takes steps to closely direct visitor activities that could result in resource degradation. Most visitor use would be highly structured through commercial service providers. The goal for commercial service operations would be to be self-contained, thus reducing the strain on the limited park facilities. Private boaters would moor at Garden Key and join tour operations. The types and levels of visitor use would be managed to protect resources and the quality of the visitor experiences.

The potential consequences and environmental impacts associated with implementing each of the alternatives are evaluated in the "Environmental Consequences" section of this document. The major impacts of implementing alternative A include continued long-term impacts on coral reefs and reef fisheries from unrestricted fishing and recreational uses. Also, increases in use would result in minor to moderate long-term adverse impacts on the quality of the visitor experience.

The major impacts of implementing alternative B would include continued long-term adverse impacts on coral reefs and reef fisheries from unrestricted fishing and recreational uses. Establishing maximum numbers of visitors at sites would have long-term minor beneficial impacts on the quality of the visitor experience.

The major impacts of implementing alternatives C and D would include a significant reduction in the long-term adverse impacts from fishing and recreational uses through the establishment of a research natural area in a portion of the park. Establishing visitor capacities, providing commercial tours throughout the park, improving and protecting the quality of the resources, and enhancing interpretation and education would have long-term major beneficial impacts on the quality of the visitor experience.

The major impacts of implementing alternative E would include the elimination of almost all of the long-term adverse impacts from fishing and recreational uses through the establishment of a research natural area throughout most of the park. Visitor use would be highly structured throughout the park. Visitors without private boats would have greater opportunities to tour diverse areas in the park. Establishing visitor capacities, providing commercial tours, improving and protecting the quality of the resources, and enhancing interpretation and education would have long-term major beneficial impacts on the quality of the visitor experience. The restriction against private boat use and recreational fishing in most of the park, and the requirement that these visitors be with a guide, would change the nature of the remote marine experience and sense of freedom now available. This would have long-term moderate negative impacts for those visitors with private boats.

Please be aware that due to public disclosure requirements, the National Park Service, if requested, is required to make the names and addresses of commentors public.

However, individual respondents may request that we withhold their name and address from the public record. If you wish to withhold your name and/or address, you must state that prominently at the beginning of your comment. The agency will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

UNDERSTANDING PARK PLANNING

The purpose of these two pages is to explain what you are going to be reading about in this document and why.

Park planning is a decision-making process, and general management planning is the broadest level of decision making for parks. General management plans are required for all units in the national park system and are intended to set the management direction for the park for the next 15 to 20 years. General management planning constitutes the first phase of tiered planning and decision making. It focuses on *why* the park was established (purpose, significance, mission) and *what* resource conditions and visitor experiences should be achieved and maintained over time (desired conditions). The general management plan looks years into the future when dealing with the framework of natural and cultural processes, considering the park holistically in its full ecological and cultural context and as part of a surrounding region. Site-specific planning will be done in later implementation plans.

There are two broad **purposes for a general management plan**:

- Clearly describe the desired conditions, the specific resource conditions and visitor experiences to be achieved in a park, and identify the kinds of management, use, and development that will be appropriate in achieving and maintaining those conditions.
- Ensure that this basic foundation for decision making has been developed in consultation with interested stakeholders and adopted by the National Park Service (NPS) leadership after an adequate analysis of the benefits, environmental impacts, and economic costs of alternative courses of action.

A **general management plan needs to do two things**:

(1) Clarify and articulate what must be achieved in the park — These requirements are based on the park's purpose, significance, special mandates, agreements, and the body of laws and policies directing the management of the national park system.

Park management is directed by law, policy, and plans — in that order. Law and policy deal with *musts* — things that must happen in the park because they have been mandated by Congress or the NPS leadership. Park managers and staffs do not make decisions about laws and policies; they simply implement them.

(2) Make decisions about the most appropriate mix of desired conditions that have been identified for a park — These desired conditions may be identified by the park staff, technical experts, current and potential visitors, other agencies, traditional users, regional/area residents, and the general public.

Laws and policies as well as the park's purpose, significance, and mission are the sideboards for determining which of the suggested desired conditions can be legitimately considered. Planning provides the process for choosing among the desired conditions. The desired conditions are grouped appropriately by concept and expressed as different alternatives. In other words, various approaches to protecting the park's resources and allowing visitor use and development may be possible. These different approaches are called the alternatives, and the alternatives are described by establishing management zones that tell what specific conditions and visitor experiences will be achieved and maintained in each particular area of the park over time. The size and placement of the different management zones usually

> varies in each alternative. Determining the best mix of desired conditions (i.e., the best alternative) is the point of the general management planning process, and decisions are based on scientific and academic resource analysis, a rigorous evaluation of the natural, cultural, and social impacts of alternative courses of action, and consideration of long-term economic costs.

The example below is meant to simply illustrate how all that bureacratese is really applied. For the example below, we are assuming that our desired conditions are in line with laws, policies, park purpose, significance, etc.

Some people might want to double the number of people allowed out to Dry Tortugas National Park so that more people could learn about and enjoy the park and its resources (a concept/ desired condition for one alternative). Others might want to limit the number of people that go to the park to researchers only so that the park's resources would always remain in near-pristine conditions (a concept/desired condition for a second alternative). Many other concepts are possible. Once concepts are formed, then decision makers (which includes the interested public) decide what actions would have to take place in the park to support this concept. They do that by establishing management zones that describe what specific conditions and visitor experiences would be achieved and maintained in each particular area of the park over time. As shown below, the size and placement of the management zones would vary with each alternative concept.

Suppose, for example, we have a historic preservation/adaptive use management zone and a research natural area zone (among others) that the planning team, park managers, the public, and others have developed as appropriate for Dry Tortugas National Park. (Different management zones would be appropriate for different parks.) In the historic preservation/ adaptive use zone we might develop many structured activities and opportunities for many visitors (primarily those on tours) to learn about the park and its resources while carefully protecting any historic structures (such as the fort). No visitors would be in the research natural area management zone because no one could enter that zone without a permit. This would help ensure the protection of the park's near-pristine resources in that management zone. In the first alternative concept (double the visitors allowed), the historic preservation/adaptive use zone might encompass Garden Key/Fort Jefferson and Loggerhead Key, and the research natural area might encompass 20 square miles of the most representative of the park's near-pristine resources. In the second alternative concept above (no one but researchers), there would be no need for a historic preservation/ adaptive use zone and the research natural area zone might encompass the entire park. Although the reader will find the management zone descriptions and alternative action descriptions in this document to be more complex, this is the basic idea of general management planning.

The other "piece" that needs to be added is an analysis of the environmental consequences (impacts) of implementing each of the alternatives — including impacts on the natural and cultural resources (will the fort and the coral beds and birds be protected?), impacts on park visitors (can visitors still fish, snorkel, and dive to shipwreck sites?), and impacts on the socioeconomic environment (can commercial charter boats still take people to fish, will the ferry to the park still run, and what will the park be like in 20 years?). These and other important questions and their answers are what general management planning is all about. The method may seem a bit complex, but the goal is simple — while considering park visitors and park resources, what is the best way to manage the park for the next 15 to 20 years.

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CONTENTS

PURPOSE OF AND NEED FOR THE PLAN

PURPOSE OF AND NEED FOR THE AMENDMENT 5
  Brief Description of the Park 5
  Park Purpose 9
  Park Significance 9
  Park Mission Goals 9
  Collective Mission and Mission Goals of the NPS South Florida Units 11
  Issues and Concerns 11
  Issues Beyond the Scope of this Plan 13
SERVICEWIDE LAWS AND POLICIES AND SPECIAL PARK MANDATES AND AGREEMENTS 14
  Park Mandates and Agreements 14
  Servicewide Laws and Policies 14
IMPACT TOPICS ELIMINATED FROM FURTHER EVALUATION 21
  Climate 21
  Air Quality 21
  Soils 22
  Prime and Unique Farmlands 22
RELATIONSHIP OF OTHER PLANNING EFFORTS TO THIS MANAGEMENT PLAN AMENDMENT 23
  U.S. Coral Reef Task Force —The National Action Plan to Conserve Coral Reefs 23
  Florida Keys National Marine Sanctuary — Draft Tortugas Ecological Reserve Supplemental Environmental Impact Statement / Draft Management Plan 23
  Gulf of Mexico —Reef Fish Fishery Management Plan 23
  South Florida Ecosystem Restoration Task Force —Strategic Plan 24
  National Park Service —Coordinated South Florida Framework 24
  State and Local Plans 24
RULEMAKING 25

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

THE PROPOSED ACTION AND THE ALTERNATIVES 29
BACKGROUND FOR DEVELOPING THE MANAGEMENT ZONES 31
  Introduction 31
  Background on Research Natural Areas 32
MANAGEMENT ZONES 34
  Historic Preservation/ Adaptive Use Zone 34
  Natural/Cultural Zone 35
  Research Natural Area Zone 35
  Special Protection Zone 36
  Managing for Visitor Experience and Resource Protection 37
  Monitoring to Maintain Visitor Experience and Resource Protection 46
PARKWIDE MANAGEMENT ACTIONS 48
ALTERNATIVE A: CONTINUE CURRENT MANAGEMENT (NO ACTION) 51
  Overall Concept 51
  Visitor Experience 51
  Resource Protection 52
  Commercial Services 52

Park Operations and Facilities 52
ALTERNATIVE B 56
  Overall Concept 56
  Visitor Experience 56
  Resource Protection 61
  Commercial Services 61
  Park Operations and Facilities 62
  Park Entrance Fee 62
ALTERNATIVE C: PROPOSED ACTION 63
  Overall Concept 63
  Visitor Experience 63
  Resource Protection 64
  Commercial Services 68
  Park Operations and Facilities 69
  Park Entrance Fee 69
ALTERNATIVE D 70
  Overall Concept 70
  Visitor Experience 70
  Resource Protection 73
  Commercial Services 75
  Park Operations and Facilities 76
  Park Entrance Fee 76
ALTERNATIVE E 77
  Overall Concept 77
  Visitor Experience 77
  Resource Protection 78
  Commercial Services 81
  Park Operations and Facilities 81
  Park Entrance Fee 81
MITIGATION MEASURES 82
  Cultural Resources 82
  Marine Life and Wildlife 82
  Traffic 82
  Visitor Experience 82
RECOMMENDATIONS FOR FURTHER RESEARCH AND PLANNING 100
ACTIONS CONSIDERED BUT ELIMINATED FROM FURTHER STUDY 101

AFFECTED ENVIRONMENT

NATURAL RESOURCES 105
  Essential and Unique Habitats 105
  Fishery Resources 113
  Wildlife Resources 115
  Environmental Setting 116
  Resource Monitoring 117
CULTURAL RESOURCES 118
  Prehistoric Archeology 118
  Shipwrecks 118
  Fort Jefferson 120
  Loggerhead Key 121

VISITOR EXPERIENCE 123
SOCIOECONOMIC ENVIRONMENT 125
  Population and income 125
  Tourism and Recreation 125
  Economy 126
  Commercial Services 129
PARK OPERATIONS AND FACILITIES 131
  Park Operations 131
  Facilities 134

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION 139
IMPACTS ON NATURAL RESOURCES 140
  Introduction 140
  Methodology 141
  Alternative A 141
  Alternative B 147
  Alternative C 148
  Alternative D 158
  Alternative E 160
  Summary and Conclusion 162
IMPACTS ON CULTURAL RESOURCES 163
  Methodology 163
  Regulations and Policies 163
  Alternative A (no action) 164
  Alternative B 165
  Alternative C 166
  Alternative D 168
  Alternative E 170
IMPACTS ON VISITOR EXPERIENCE 172
  Methodology 172
  Alternative A 173
  Alternative B 175
  Alternative C 176
  Alternative D 179
  Alternative E 182
IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT 185
  Methodology 185
  Alternative A 185
  Alternative B 187
  Alternative C 188
  Alternative D 190
  Alternative E 191
IMPACTS ON PARK OPERATIONS AND FACILITIES 194
  Methodology 194
  Alternative A 194
  Alternative B 196
  Alternative C 197
  Alternative D 198

Alternative E 200
UNAVOIDABLE ADVERSE EFFECTS 202
Alternative A 202
Alternative B 202
Alternative C 202
Alternative D 203
Alternative E 203
RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY 205
Alternative A 205
Alternative B 205
Alternative C 205
Alternative D 206
Alternative E 207
IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES 208
Alternative A 208
Alternative B 208
Alternative C 208
Alternative D 208
Alternative E 209
IMPACTS ON ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL 210
Alternative A 210
Alternative B 210
Alternative C 210
Alternative D 210
Alternative E 211
ENVIRONMENTAL JUSTICE POLICY 212

CONSULTATION AND COORDINATION 213

APPENDIXES 217

APPENDIX A: PARK'S ENABLING LEGISLATION, PUBLIC LAW 102-525 219
APPENDIX B: COLLECTIVE MISSION AND MISSION GOALS OF THE NPS SOUTH FLORIDA UNITS 221
APPENDIX C: EXECUTIVE ORDER 13089 "CORAL REEF PROTECTION" 224
APPENDIX D: CARRYING CAPACITIES 227
APPENDIX E. MORE DETAILS ON COMMERCIAL SERVICES 232
APPENDIX F: RATIONALE FOR SELECTION OF ALTERNATIVE C AS THE PARK SERVICE'S PROPOSED ACTION 233
APPENDIX G: DETAILS OF NATURAL RESOURCE DATA GATHERED AND PROJECTED 244
APPENDIX H: LETTERS FROM THE U.S. FISH AND WILDLIFE SERVICE ON RARE, THREATENED, AND ENDANGERED SPECIES 247
APPENDIX I: METHODS FOR ASSESSING IMPACTS ON NATURAL RESOURCES 258
APPENDIX J: SUBMERGED CULTURAL RESOURCES STRATEGY 262

SELECTED REFERENCES 266

PREPARERS AND CONSULTANTS 271

INDEX 272

MAPS

South Florida National Park Units 3
Park 7
Alternative A 53
Alternative B 57
Detail of Historic Preservation / Adaptive Use Zone Boundary, All Alternatives 59
Alternative C 65
Alternative D 71
Alternative E 79

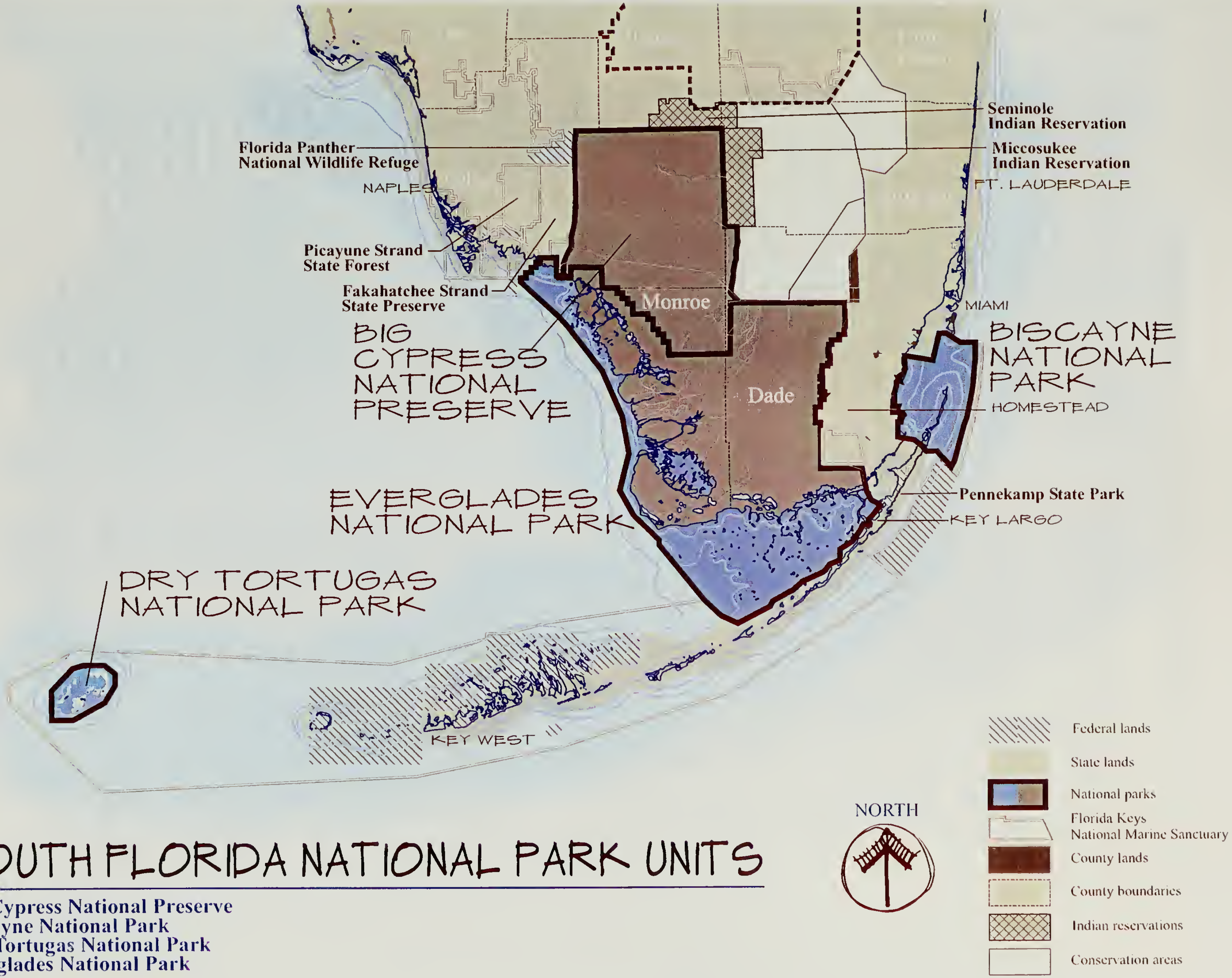
TABLES

Table 1. Historic Preservation/Adaptive Use Zone 38
Table 2. Natural/Cultural Zone 40
Table 3. Research Natural Area 44
Table 4. Parkwide Management Actions, All Alternatives 48
Table 5. Summary of Parkwide Management Actions 83
Table 6: Summary of Alternative Actions 84
Table 7. Summary of Impacts 87
Table 8: Average Trip Expenditures Per Person 128
Table 9. CUA Permits Issued for the 1999 Season 129
Table 10. Cultural Resource Compliance with Section 106 214

FIGURES

A1. List of stony coral, gorgonian, and sponge species sampled in the Florida Keys coral reef tract by NURC divers, 1998–99. 107
B1. Spatial distribution of coral reef, hardbottom, and sea grass habitats in the Dry Tortugas region. 109
B2. Distribution of benthic habitats within the park boundaries. 111
A3. List of families and species of fishes observed in visual samples from the Florida Keys. 114
B13. Overall AHP model scores for five management alternatives. 149
B7. Results of the 20-year spatial simulations of the efficacy of the various management alternatives for all grouper species. 151
B9. Results of the 20-year spatial simulations of the efficacy of the various management alternatives for all snapper species. ·153
B11. Results of the 20-year spatial simulations of the efficacy of the various management alternatives for all grunt species. 155

PURPOSE OF AND NEED FOR THE PLAN



SOUTH FLORIDA NATIONAL PARK UNITS

Big Cypress National Preserve
Biscayne National Park
Dry Tortugas National Park
Everglades National Park

Department of the Interior • National Park Service
DSC • May 2000 • 160, 364, 169, 176 • 20,061B

PURPOSE OF AND NEED FOR THE AMENDMENT

General management plans are required for each unit of the national park system. These plans provide a clearly defined direction for visitor use and resource preservation and provide a basic foundation for decision making and managing the park unit for the foreseeable future.

The purpose of this *Draft General Management Plan Amendment / Environmental Impact Statement* for Dry Tortugas National Park is to set forth the management philosophy and framework for decision making and problem solving in the park for the next 15 to 20 years. The park has been operating under the *General Management Plan / Development Concept Plan / Environmental Assessment* that was prepared in 1983 (for Fort Jefferson National Monument) before the site was designated as a national park in 1992. Although much of the 1983 plan is still applicable, NPS planning guidance has changed and this older plan does not address current issues. The older plan needs amending to provide overall guidance for the future use of resources and facilities; to clarify research and resource management needs, priorities, and strategies; and to address changing levels of park visitation and use. When completed, this new *General Management Plan Amendment* will replace the 1983 plan.

Specific issues to be addressed in this amendment include protection of near-pristine resources such as coral reefs and sea grass beds, the protection of submerged cultural resources, the management direction of commercial services to provide transportation and assistance in educating visitors, and the determination of appropriate levels and types of visitor use. In 1984 the park had 18,000 visitors Establishing appropriate levels of visitor use is especially important. Last year more than 84,000 people visited the park. The first quarter visitation numbers of 2000 are 25% greater than last year. Managers must take actions to deal with visitor safety and enjoyment as well as protect the resources (see "Issues and Concerns" section).

This *General Management Plan Amendment* presents and analyzes five alternative future directions for management and use of Dry Tortugas National Park (the park or Dry Tortugas). Alternative A, a "no-action" alternative, presents what would happen under a continuation of existing conditions, without a new management plan, and provides a basis for comparing the other alternatives. Alternatives B, C, D, and E (the "action alternatives") considered in this document provide different ways to meet current and future needs, protect park resources, and enhance visitor experience. Alternative C has been identified as the National Park Service's proposed action/ preferred future direction. The potential consequences and environmental impacts associated with implementing each of the alternatives are evaluated in the "Environmental Consequences" section of this document.

Visitation to the park has traditionally relied on and would continue to rely on commercial transportation providers under any of the alternatives discussed in this document. For that reason, this plan addresses ways for commercial services to help provide for visitor experiences in each alternative. The impacts on commercial operators are analyzed in the "Environmental Consequences" section of this document. A subsequent concessions contract prospectus will follow this *General Management Plan Amendment/ Environmental Impact Statement* to outline specific operations and equipment needed to implement the selected alternative.

BRIEF DESCRIPTION OF THE PARK

Established in 1992 (Public Law 102-525, Title II, Oct. 26, 1992), Dry Tortugas

National Park is in Monroe County, Florida, 70 miles west of Key West in the Straits of Florida. The park's approximate 100-square-mile jurisdiction includes seven small keys (islands) composed of coral reefs and sand and the surrounding shoals and water. Totaling 104 acres, the islands are known as the Dry Tortugas and are situated on the edge of the main shipping channel between the Gulf of Mexico, the western Caribbean, and the Atlantic Ocean. The islands and reefs pose a serious navigation hazard to ships passing through the 75-mile-wide straits between the gulf and the ocean and have been the site of hundreds of shipwrecks. The earliest known shipwreck occurred in 1622, and marine casualties, wrecks, and strandings still occur in the area. The shipwrecks on the reefs comprise one of the nation's principal ship graveyards.

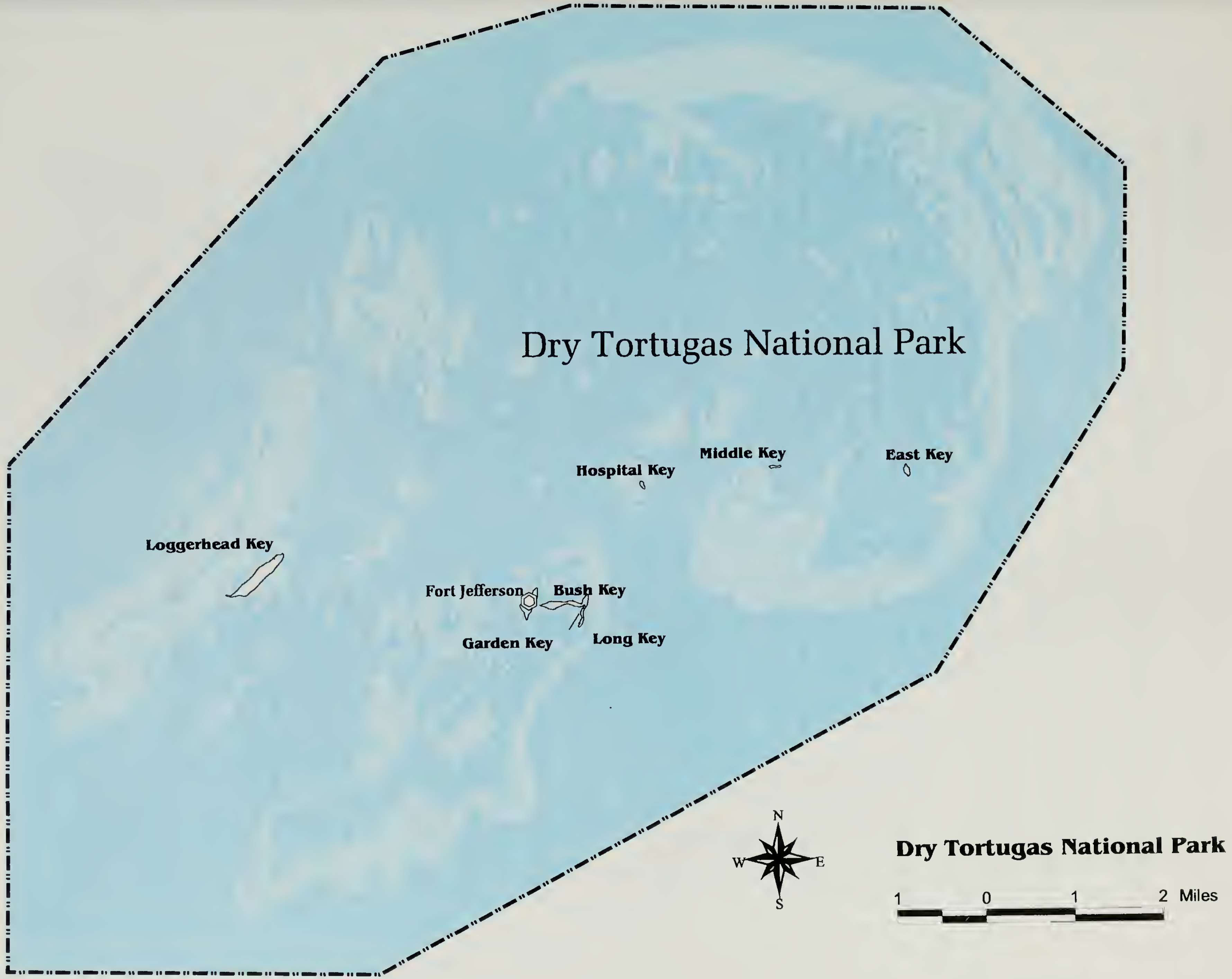
Fort Jefferson, on Garden Key, is the park's central cultural feature and is the largest 19th century American coastal fort. Construction began on the structure in 1846 but was never completed. Originally built to protect shipping access to the gulf, the fort was used as a military prison during the Civil War, housing Union deserters and four Lincoln assassination conspirators. Today, the fort is the primary destination site for people visiting the park.

The lighthouse on Loggerhead Key is the most prominent historic structure on that key. Completed in 1858, the 150-foot tower provides warning of the Tortugas' dangerous reefs. Also on this key are the ruins of the world's first marine biological laboratory in the Western Hemisphere — the Carnegie Institution of Washington, D.C., Marine Biology Laboratory.

Loggerhead Key is the largest key and contains a brick tower lighthouse built in 1857 that is still operable. The lighthouse was manned by Coast Guard personnel until recently, when it was turned over to the National Park Service. The remaining keys are Bush, Long, East, Hospital, and Middle. Because they are turtle and bird nesting sites, Hospital and Long Keys are closed to visitors all year; Bush Key is closed part of the year during bird nesting season. Middle Key is a sandbar that is awash in the summer but emerges intermittently at other times of the year.

The Dry Tortugas are recognized for their near-pristine natural resources including sea grass beds, fisheries, and sea turtle and bird nesting habitat. Pristine, for the purposes of this document, means in an unaltered natural condition, and near-pristine means in an unaltered natural condition but having minor effects from current levels of recreational use and broader environmental influences. In addition, the tropical coral reef of the Tortugas is one of the best developed and most pristine on the continent and possesses a full range of Caribbean coral species, some of which are rare elsewhere. These resources play a vital role in South Florida's efforts to attain a balanced and sustainable ecosystem. For example, the park's protected spawning habitat produces larger apex predators (predators at the top of the food chain) and rich biodiversity of species such as reef fish, lobster, and shrimp. Movement and flow of currents in the keys disperse larva to distant areas, resulting in benefits to the region's fisheries and therefore to recreational and commercial fishermen beyond the park, as well as to research scientists.

The primary means of access to the park are by commercial boat (tours) or seaplane or private boat. Visitors come to the area for recreational opportunities including touring Fort Jefferson, snorkeling, scuba diving, birdwatching, boating, and recreational fishing.


Dry Tortugas National Park
Hospital Key
Middle Key
East Key
Loggerhead Key
Fort Jefferson
Bush Key
Garden Key
Long Key
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Dry Tortugas National Park
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2
Miles

PARK PURPOSE

The reason(s) for which the park was established provides the most fundamental criterion for determining actions proposed in the general management plan.

Dry Tortugas National Park was established to "preserve and protect for the education, inspiration, and enjoyment of present and future generations nationally significant natural, historic, scenic, marine, and scientific values in South Florida." The new park supplanted its smaller predecessor, Fort Jefferson National Monument (established in 1935). The following management purposes were identified in the enabling legislation (see appendix A for the complete text of the legislation):

- Protect and interpret a pristine subtropical marine ecosystem, including an intact coral reef community.
- Proactively manage populations of fish and wildlife, including loggerhead and green sea turtles, sooty terns, frigate birds, numerous migratory bird species, and other sensitive species.
- Safeguard the pristine natural environment of the Dry Tortugas group of islands.
- Protect, stabilize, restore, and interpret Fort Jefferson, an outstanding example of 19th century masonry fortification.
- Preserve and protect submerged cultural resources.
- Provide opportunities for public enjoyment and scientific research in ways consistent with the park purpose.

PARK SIGNIFICANCE

The following statements define the significant attributes that relate to the park purpose and why the park was established. Knowing the park's significance helps managers set protection priorities and determine desirable visitor experiences.

Dry Tortugas National Park is a significant unit in the national park system because it

- contains historic Fort Jefferson, a militarily and architecturally significant 19th century fort
- protects the historic Loggerhead Key lighthouse and the historic Garden Key harbor light
- possesses one of the greatest concentrations of historically significant shipwrecks in North America, with some dating back to the 1600s
- maintains one of the most isolated and least disturbed habitats for endangered and threatened sea turtles in the United States
- supports the only significant sooty and noddy tern nesting colonies in the United States (on Bush and Long Keys) and harbors the only frigate bird nesting colonies in the continental United States (on Long Key)
- serves as an important resting spot for migrating birds
- provides unique opportunities to see tropical seabirds
- protects the least disturbed portion of the Florida Keys coral reef ecosystem
- presents outstanding potential for education, recreation, and scientific research related to the park's exceptional marine resources
- offers a sense of quiet remoteness and peace in a vast expanse of sea and sky
- affords an opportunity to understand and appreciate a rare combination of natural, historic, marine, and scenic resources

PARK MISSION GOALS

Given the purpose and significance, goals were developed to provide guidance in preserving and protecting what is significant and *communicating the primary themes to the visitors.*

These are immediate and long-term goals — what actions would have taken place over the life of this plan amendment (15–20 years) — to fulfill resource protection, visitor use, and operational mandates.

All submerged and land-based cultural resources have been identified, documented, protected, and/or stabilized.

All terrestrial archeological resources have been identified, documented, evaluated, and protected.

All submerged cultural resources in 30 feet or less of water have been identified, documented, evaluated, and protected.

One example of each type of armament and the hot shot oven at Fort Jefferson have been restored.

All periods of Dry Tortugas history have been researched and documented.

All historic structures at Dry Tortugas, including Fort Jefferson and the Loggerhead Key lighthouse, have been stabilized.

The type and level of public use does not negatively impact cultural resources.

All natural resources and associated values are protected, restored, and maintained in near-pristine condition.

Habitats impacted by humans are restored, and the natural environment is suitable for use by sea turtles and migrating birds.

Native plants and animals are not impaired by invasive, exotic plants.

The physical oceanography (currents, tides, and winds) in the area is understood and is used to manage remote sources of pollutants.

The park is internationally recognized as a center for marine research.

The type and level of public use does not negatively impact natural resources.

Human-caused physical damage to reefs and sea grass meadows is eliminated, and natural populations of fish and marine life are maintained.

Management decisions are based on sufficient data, and park policies support and enhance the survival of threatened and endangered species.

Visitors understand, appreciate, and are inspired by the park's historical and natural resources, and they support the protection of these resources.

Dry Tortugas provides only minimal onsite visitor services and facilities and requires park visitors to be self-sufficient for all their supplies.

The quality of the visitor experience is protected by sustaining the park's peaceful and remote character.

All visitors and affiliated political entities and interest groups understand why the park was established and work cooperatively to achieve its purpose and mission.

Commercial operators are aware of park purpose and convey that to their customers.

Available park facilities, infrastructure, and services are sufficient to support operational needs, park staff, and visitors; appropriate recreational opportunities are safe and adequate for visitors and employees.

Facilities and infrastructure are sufficient to support park operations and visitor needs, in conformance with state and federal laws and the park purpose.

Dry Tortugas National Park is a responsive and efficient organization, enhancing managerial capabilities through initiatives and support from other agencies, organizations, and individuals.

Title to Loggerhead Key and submerged lands within the park boundary are transferred to the park, in accordance with the park's enabling legislation.

Cooperative relationships are developed to assist in and carry out the park purpose.

COLLECTIVE MISSION AND MISSION GOALS OF THE NPS SOUTH FLORIDA UNITS

Collectively, the South Florida parks face similar challenges and demands. They confront related environmental threats and impacts from urban growth. They share common publics and visitor needs, and they maintain relationships with many of the same public and private entities throughout South Florida. They preserve the most intact portions of the South Florida ecosystem and play vital roles in sustaining the health of that system. Because the parks have so much in common, it is imperative that they coordinate the management strategies, crossing unit and agency boundaries in ways that serve the ecosystem's overall needs.

To meet these challenges, the four parks have identified a common mission and a series of mission goals (see appendix B). The mission reflects the collective purpose, significance, and special mandates of the National Park Service in South Florida. The mission goals identify what the parks envision as desired future conditions. Both the mission and the mission goals conform to the NPS *Strategic Plan*. The collective mission goals, however, have been redefined so that they fit the needs of the South Florida parks.

ISSUES AND CONCERNS

The public, park staff, and planning team members (the team of people responsible for preparing this plan) identified a number of issues facing Dry Tortugas National Park. The issues and concerns generally involve determining the appropriate visitor capacity, types and levels of facilities, services, and activities while remaining compatible with desired resource conditions. The general management plan amendment will provide a framework or strategy for addressing the following issues within the context of the park's purpose, significance, and mission goals.

- Visitation at Dry Tortugas National Park has risen from 18,000 visitors in 1984 to 84,000 visitors in 1999. The first quarter visitation numbers of 2000 are 25% greater than last year. Increased popularity of the park strains facilities, compromises visitor safety and quality of visitor experience, and threatens resources. The number of visitors and types and levels of activities lack balance against the needs of vegetation, wildlife and aquatic life, historic structures, and their environments. There are concerns that the trend in increased visitation will destroy the very resource qualities that make the area special.

- Research indicates that recreational fishing, especially for trophy fish, is having a significant detrimental impact on the fisheries in the entire region. The contribution of these largest fish to production in the Tortugas region is essential to the marine-based ecology and economy.
- There has been a steady increase of interest by the commercial sector during the past few years to operate in the park. Interest has been expressed for much larger vessels, which would bring many more visitors into the park. Park managers were concerned that the fragile resources in the park might suffer as a result of the increases being contemplated. This resulted in a moratorium being placed on new commercial activity in the park until this planning effort was completed. Park managers need the direction from this plan to efficiently and effectively manage appropriate types and levels of commercial services at Dry Tortugas National Park.
- Although many of the park's resources maintain high levels of integrity and near-pristine conditions, some resources such as coral reefs and sea grass meadows are being degraded by pollution from outside the park and by damage from divers, snorkelers, and the use of anchors. In addition, the potential exists for the loss of historic fabric at Fort Jefferson and artifacts at shipwreck sites. As visitation increases, resource values could be compromised even more. Lacking strategies to balance location and density of visitor activities will make it difficult for the park to protect, restore, and maintain resource conditions.
- Dry Tortugas National Park contains many natural and cultural resources across a vast expanse of sea. Transportation to and within the park allows visitors limited access to park resources, which minimally achieves the park goals of educating visitors and providing a quality experience. Without a vessel, those resources are relatively inaccessible to most visitors. Commercial services support a variety of visitor activities, including sailing; transportation by boats, ferries, and air taxis; and guided history tours and tours for photography, wildlife watching, snorkeling, diving, and fishing. Although activities are appropriate for private individuals to enjoy, it is equally appropriate to offer these activities for visitors through the commercial sector. However, the current park management framework lacks critical tools for initiating, continuing, modifying, or eliminating commercial services at specified locations. Many public commentors acknowledge the value of commercial services but express concern that irreparable damage to the park's sensitive cultural and natural resources could result from overuse unless visitation levels and types of activities and their locations are balanced with resource preservation.
- Most visitors come between March and July. Visitors seeking quiet and solitude during this time complain that these experiences are not available due to overcrowding and overuse. A continued increase in visitation numbers will likely degrade the experience even more for some visitors. With more users, noise levels would likely increase, and there would be more competition for services and facilities and increased safety concerns. The management tools currently in use do not limit the numbers of visitors or disperse visitors to maintain a safe and high-quality experience during peak visitation periods.

- Visitors and the general public have expressed varying opinions as to the type and level of facilities that the park should offer. Some prefer minimal facilities, while others would like additional restrooms, campsites, showers, mooring buoys, and dock space. Infrastructure such as the sewage disposal system is inadequate for current levels of visitation. Freshwater storage and processing are at capacity and will not support additional demand. Options to provide basic utilities and other facilities are greatly restricted by the limited land area, its closeness to open water, and the need to generate power to treat water and wastewater. Power must be generated onsite with diesel-fueled generators. Also, intrusions into historic and submerged cultural resource sites present concerns. Currently, there is an imbalance between visitation levels, facility and infrastructure capacity, and the need to maintain near-pristine resource qualities in accord with the park's purpose.

- Although research programs are implemented when funds permit, an ongoing program with cultural and natural resource indicators and a monitoring system to determine status and trends of resource conditions do not exist. Without baseline natural and cultural resource information, the National Park Service cannot become aware of undiscovered significant resources in the park, impacts affecting resources, and management strategies needed to maintain and protect the resources.

- The National Park Service is increasingly aware of the need to develop a mutually beneficial working relationship that extends beyond park boundaries. This need holds true in working with various entities including other government agencies, community groups, commercial organizations, and individuals. As interest in the Dry Tortugas area increases, there are opportunities to establish partnerships with other managers and operators.

ISSUES BEYOND THE SCOPE OF THIS PLAN

This plan is intended to establish general, conceptual guidance for the management of Dry Tortugas National Park. Subsequent plans and reports will implement this general management plan and provide more detailed management direction. These plans would include a concessions contract prospectus, in which specific commercial services parameters, feasibility analysis, and operations options would be outlined. The park also needs an interpretive plan that establishes interpretive themes and the ways they will be communicated to the visitor and the public at large. These implementation plans and details are beyond the scope of this management plan. (See the "Recommendations for Future Research and Planning" section for more information.) No other issues were raised during scoping that are beyond the scope of this management plan.

Although many of the park's resources maintain high levels of integrity and near-pristine conditions, some marine resources such as coral reefs and sea grass meadows are being degraded by pollution, climate changes, and extreme natural events. These external forces are beyond the scope of this plan.

SERVICEWIDE LAWS AND POLICIES AND SPECIAL PARK MANDATES AND AGREEMENTS

In the process of preparing this *General Management Plan Amendment,* the planning team looked at things the park must do regardless of which alternative is implemented. These "must dos" fall into two categories — (1) things that are required because of laws and policies that apply throughout the National Park Service (servicewide), and (2) things that are specific to Dry Tortugas National Park because they are mandated in the park's establishing legislation or that are required because of a signed agreement with others.

PARK MANDATES AND AGREEMENTS

There are no special park mandates or agreements in the legislation that established the park other than fulfilling the park purposes stated previously.

SERVICEWIDE LAWS AND POLICIES

General

Law or Policy	Management Direction / Action
NPS Organic Act	The National Park Service will "conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."
Public Law 95-625; NPS M*anagement Policies*; 16 USC 1a-7(b)(4)	NPS management plans must include measures for protecting the parks' resources and "indications of potential modifications to the external boundaries of the unit and the reasons therefore" (PL 95-625).

Natural Resources

The primary goal of natural resource management is to preserve the components and processes of the Dry Tortugas' naturally evolving ecosystems. These components include the natural abundance, diversity, and ecological integrity of the park's wildlife and vegetation. The park's natural resources will continue to be managed in accordance with laws and NPS policies and regulations, including those below.

Law or Policy	Management Direction / Action
National Environmental Policy Act Guidelines, NPS-12	**Natural Resources — General:** This act directs agencies to "encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man and to enrich the understanding of the ecological systems and natural resources important to the Nation . . . . "
NPS *Management Policies* NPS *Natural Resources Management Guideline* (NPS-77) Endangered Species Act of 1973 Migratory Bird Conservation Act of 1929 Fish and Wildlife Coordination Act of 1958 Marine Mammal Protection Act of 1972	Policies and guidelines for natural resources direct that the park must • Identify and complete the inventories of natural resources for baseline information. • Maintain and protect the natural ecological processes occurring in the Dry Tortugas and its immediate environs. • Minimize impacts of human activities, developments, and uses on marine and terrestrial resources. • Establish systems to monitor the condition of key natural resources and to identify and monitor threats to those resources. • Continue to close areas of the park to protect birds and turtles during nesting season. • Manage endangered, threatened, and candidate species.
Title 36 *Code of Federal Regulations* 1.5, 1.6 1.10, 2.1, 2.2, 2.3, 2.4, 2.5	The 36 CFR provides authorization for • Closing areas and limit public use to protect resources • Providing public notice of closures or use limits. • Prohibiting the destruction, defacing, or disturbing resources. • Protecting fish and wildlife and permit research.
NPS *Natural Resources Management Guideline* (NPS-77)	**Research Natural Areas:** "Managers should give consideration to the establishment of restricted waters in which no fishing is allowed. These areas can be valuable for the study of unaltered ecological processes and serve as important baselines or control areas for harvested populations of fish." (Chapter 3, page 34) "Prime examples of natural ecosystems and areas with significant genetic resources with value for long-term baseline observational studies or as control areas for comparative studies involving manipulative research outside the park may be recommended ... for designation as research natural areas. Research natural areas will be managed to provide for greatest possible protection of site integrity in accordance wit their designation. Activities in research natural areas will be restricted to nonmanipulative research, education, and other activities that will not detract for the area's research values." (Chapter 4, Special Park Designations, pg. 14)
Executive Order 13089, Coral Reef Protection, signed June 11, 1998, by President Clinton.	**Coral Reefs:** The order helps fulfill the purposes of the Clean Water Act of 1977, as amended (33 USC 1251, et seq.), the Coastal Zone Management Act (16 USC 1451 et seq.), the Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801, et seq.), the National Environmental Policy Act of 1969, as amended (42 USC 4321, et seq.), the National Marine Sanctuaries Act (16 USC 1431, et seq.), the National Park Service Organic Act (16 USC 1m et seq.), the National Wildlife Refuge System Administration Act (16 USC 668dd-ee), and other pertinent statutes, to preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment (see appendix C for Executive Order 13089).

	The order directs that all federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems, and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems. The U.S. Coral Reef Task Force duties include coral reef mapping and monitoring; research; conservation, mitigation, and restoration; and international cooperation. Development of the general management plan amendment for Dry Tortugas National Park has been consistent with the directives of this order. Duties and plans of the U.S. Coral Reef Task Force will support and not supercede recommendations of this management plan.
Executive Order 11990, “Protection of Wetlands”	**Wetlands:** This order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction of modification of wetlands.
Executive Order 11988, “Floodplain Management”	**Floodplains:** This order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modifications of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.
National Parks Omnibus Management Act of 1998, Title II, Resource Inventory and Management	**Scientific Research and Monitoring:** Title II, Sec. 201. Purposes. The purposes of this title are — (2) to enhance management and protection of national park resources by providing clear authority and direction for the conduct of scientific study in the national park system and to use the information gathered for management purposes; (4) to encourage others to use the national park system for study to the benefit of park management as well as broader scientific value, where such study is consistent with the National Park Service Organic Act of 1916 Sec. 204 Inventory and Monitoring Program The Secretary shall undertake a program of inventory and monitoring of national park system resources to establish baseline information and to provide information on the long-term trends in the condition of national park system resources. The monitoring program shall be developed in cooperation with other federal monitoring and information collection efforts to ensure a cost-effective approach. Sec. 206. Integration of Study Results into Management Decisions The Secretary shall take such measures as are necessary to assure the full and proper utilization of the results of scientific study for park management decisions.
NPS *Natural Resources Management Guideline* (NPS-77), Chapter 2, page 95	**Marine Resources:** “Objectives for marine resource management are the following: 1. Inventory all ecosystem components 2. Maintain and restore all components and processes of naturally evolving park marine ecosystems, recognizing that change caused by extreme natural events (e.g., storms, red tide, El Niño) is an integral part of functioning natural systems. 3. Maintain natural genetic diversity of marine ecosystems. 4. Maintain or improve water quality affecting marine ecosystems. 5. Maintain or improve air quality affecting marine ecosystems. 6. Maintain natural marine viewsheds. 7. Protect and restore threatened and endangered species and their critical habitat.

	8. Regulate and mitigate human activities to minimize adverse impacts. 9. Determine limits of natural system variation (baseline condition). 10. Monitor system dynamics to detect abnormal changes in time to affect remedial actions. 11. Educate visitors about the importance and fragility of marine resources, threats to them, and mitigation to lessen impact."

Cultural Resources

Under all alternatives, the park's cultural resources (land-based and submerged) will be protected and preserved in accordance with applicable laws and NPS policies and regulations, including those listed below.

Law or Policy	Management Direction / Action
The Secretary of the Interior's Standards for the Treatment of Historic Properties (1995) NPS *Director's* Order #28 (1998)	**Land-based Cultural Resources:** Continue preservation measures at Fort Jefferson to arrest masonry deterioration and retain the essential architectural character and configuration of the structure and its contributing features. All stabilization and preservation/maintenance undertakings will follow *The Secretary of the Interior's Standards for the Treatment of Historic Properties.*
The Secretary of the Interior's Standards for the Treatment of Historic Properties (1995) NPS *Director's* Order #28 (1998) National Historic Preservation Act (1966)	Preserve and protect land-based national register properties — e.g., Fort Jefferson and the Loggerhead Key lighthouse and associated structures
NPS *Director's* Order #28 (1998) Archeological Resources Protection Act, (1979) National Historic Preservation Act (1966)	Assess all activities, including ground or offshore disturbances, for the potential to disturb archeological resources. If significant resources were identified in project areas, avoid them if at all possible, or undertake appropriate data recovery measures before possible construction disturbance.
NPS *Management Policies* (1988); NPS *Abandoned Shipwreck Act Guidelines* (1990), National Historic Preservation Act (1966)	**Submerged Cultural Resources:** ▪ In accordance with appropriate professional standards, stabilize and preserve historic shipwrecks and submerged cultural resources in place. ▪ Permit limited archeological investigations only under an approved research design. ▪ Document and evaluate the significance of submerged cultural resources according to the eligibility criteria of the National Register of Historic Places. ▪ Monitor submerged cultural resources to assess site conditions and undertake remedial preservation treatments as necessary. ▪ Assess the suitability of documented sites for public visitation/interpretation. Sensitive sites would remain off limits to the public. ▪ Continue archeological surveys to inventory and evaluate submerged cultural resources within the park at depths of less than 30 feet. Eventually, complete archeological survey for the entire park waters at all depths

Visitor Use and Safety

Law or Policy	Management Direction / Action
Safe harbor adheres to marine traditions.	**Safe Harbor:** Because the park contains the only islands for many miles, afford safe harbor to any vessel when warranted.
An executive memorandum *signed* by President Clinton on April 22, 1996 directed the Federal Aviation Administration and the National Park Service to "develop appropriate educational and other materials for the public at large and all aviation interests that describe the importance of natural quiet to park visitors and the need for cooperation from the aviation community." NPS *Management Policies*	**Natural Soundscape:** Americans regard parks as national treasures set aside to preserve this country's natural and cultural heritage and associated values and resources. The park system includes some of the quietest places on earth, and this quiet is valued as a resource in keeping with the NPS mission. The resource is called the natural soundscape and includes silence, solitude, and tranquility along with sounds of nature such as birds calling or waves gently washing against the shore. Soundscape also involves those sounds inherent in cultural settings. Today, many parks may *appear* as they once did historically, but they no longer *sound* as they did in the past. Increasingly, intruding external and internal sources of noise affect not only the visitor experience but the resources as well. As stated by NPS Director Robert Stanton, "Natural sounds are part of the special places we preserve. Rustling winds in the canyons and the rush of waters in the rivers are the heartbeat and breath of some of our most valuable resources." Noise sources in Dry Tortugas include watercraft, aircraft, generators, and other equipment associated with maintenance and park operations. In addition, visitors themselves may be a source of intrusive sounds. Proper management of noise sources is necessary to preserve or restore the natural soundscape.
National Parks and Recreation Act, 1978	**Levels of Visitation/Carrying Capacity:** The National Park Service is required by law to address carrying capacity (how many people can visit the park and specific sites without damaging the resources or visitor experience) in planning for parks. One product of the process for developing this general management plan amendment was the identification of a range of numbers that would indicate the visitor carrying capacities for key park areas. These capacities acknowledge the strong relationship among the number of visitors, the quality of the visitor experience, and impacts on the resources. Specific use capacities for park sites such as coral reefs and Fort Jefferson have been defined based on current scientific information and daily park operational knowledge (see tables 1-3 and appendix D.) The process for determining carrying capacities includes • Developing management zones that define desired visitor experience and resource conditions for each area of the park. • Determining a range of the number of visitors at one time at specific sites and attractions. • Developing indicators that can be monitored to ensure that desired visitor experience and resource conditions are achieved.

	- Developing a systematic monitoring process. - Incorporating the freedom to lower or raise capacities if standards indicate that no resource damage is occurring or standards warn that conditions require management action.
Americans with Disabilities Act; *Uniform Federal Accessibility Standards*; and NPS *Management Policies;* Architectural Barriers Act of 1968; Rehabilitation Act of 1973	**Accessibility:** Make visitor and management facilities as accessible as practicable, depending on the nature of the area and of the facility, to persons with visual, hearing, mobility, and mental impairments. Strive to provide the highest level of accessibility possible to facilities, programs, and services, consistent with the nature of the area, the conservation of resources, and the mandate to provide a quality experience for everyone. Meet accessibility standards on visitor transportation vessels and aircraft within the limits of marine and aircraft design and safety requirements. Work with organizations that encourage and enable use of park areas by special populations, which will increase awareness of the needs of these populations and help to ensure that potential visitors with particular needs are aware of the opportunities offered at the Dry Tortugas.
NPS *Management Policies; Loss Control Management Program Guidelines* (NPS-50); *Federal Assistance and Interagency Agreement Guideline* (NPS-20); National Security Decision Directive 259.	**Visitor Safety:** Although visitors assume a certain degree of responsibility for their own safety when visiting Dry Tortugas, strive to ensure that there are no hazards posing a serious threat to human health and safety. Ensure that actions to prevent known hazards will not conflict with NPS mandates to preserve the park's resources.
NPS *Management Policies*, chapter 7	**Interpretation and Education**: The National Park Service will conduct interpretive programs in all parks to instill an understanding and appreciation of the value of parks and their resources; to develop public support for preserving park resources; to provide the information necessary to ensure the successful adaptation of visitors to park environments; and to encourage and facilitate appropriate, safe, minimum-impact use of park resources.

Commercial Services

Law or Policy	Management Direction / Action
The Omnibus Park Management Act of 1998 was passed by Congress and signed into law November 13, 1998. Section IV of the Omnibus Act, which deals directly with NPS concessions, is called the National Park Service Concessions Management Improvement Act of 1998. This legislation supercedes the Concessions Policy Act of 1965, which has guided Park Services management of concessions for the last 30 years. The *U.S. Code of Federal Regulations* (36 CFR) section 5.3 requires that all commercial activities in national parks be authorized by a written instrument (contract or permit). The Cost Recovery Act (16 USC 3a) requires the National Park Service to recover all costs associated with administering and monitoring business permits. The National Park Service guidelines that are applicable to commercial services include: * *Concessions Guidelines* (DO–48) * *Loss Control Management Program Guideline* (DO–50) * *Special Park Uses Guidelines* DO–53 * *Public Health Management Guideline* (DO–83) These guidelines, along with fundamental policies, standard contract language, and operating practices, are used in managing commercial activities throughout the national park system.	**Concession Activities:** Concession activities and development shall be limited to those facilities and services that are necessary and appropriate for public use and enjoyment of the park. All commercial activities shall be consistent with the preservation and conservation of resources and values for which the park was established. Concession activities should be authorized in a manner consistent with a reasonable opportunity for the concessioner to realize a profit. To encourage competition among perspective bidders Existing concessioners would not have a preferential right of renewal. For further details, see appendix E.

Energy Management

Law or Policy	Management Direction / Action
Executive Order 13123, "Greening the Government through Efficient Energy Management (PL 95-619, 92 Stat.. 3206, 42 USC 8252 et seq.)	**Energy Management:** This order has many requirements, but the bottom line is that agencies have been given a goal to reduce their energy consumption by 30% from the base year of 1990 by the year 2010.

IMPACT TOPICS ELIMINATED FROM FURTHER EVALUATION

The following impact topics were eliminated from further evaluation. These topics are briefly discussed below and are not analyzed in detail in this document due to the following: (a) implementation of the alternatives would have no discernible effect on the topic or resource or (b) the resource does not occur in the park.

CLIMATE

The Dry Tortugas region has a tropical maritime climate, driven in large part by the influence of the Caribbean Sea and the Bermuda/Azores high pressure system. Seasonal variations in position and interactions with other air masses affect temperature, precipitation, and wind speed in the lower Keys. Two primary climatic seasons are present. The rainy season occurs from about May to October. The dry season typically extends from November to April. In addition to a comparative reduction in rainfall, the dry season is punctuated by rapidly dissipating cold fronts. Winds from the east-southeast typically prevail during the rainy season, and from the east-northeast during the dry season. These wind patterns are disrupted by occasional cyclonic disturbances, including hurricanes, during the rainy season and cold fronts accompanied by strong winds from the northwest during the dry season.

Temperatures in the Florida Keys are the most moderate in Florida, and Key West receives about 3,300 hours of sunshine per year, the most in the state (Schomer and Drew 1982). Temperatures in the Dry Tortugas vary little from the rest of the Keys, typically being within 33°F to 37°F (1°C to 3° C) of other areas. Highest temperatures typically occur in July and August and approximate 90°F (32°C). Lowest temperatures typically do not drop below 66.2°F (19° C).

The Keys are the driest area in Florida. Due to its relatively remote positioning from the mainland and Florida Bay, the Dry Tortugas is one of the driest areas in the Keys. Precipitation averages about 49 inches (125 centimeters) per year with 66% to 80% of the total annual precipitation occurring from May to October (Schomer and Drew 1982). Most rainfall results from local convective storms, which occur most typically in September and are least common in March. Precipitation from individual hurricanes typically ranges from 5 to 10+ inches (13 to 26) centimeters but can exceed 19.7 inches (50 centimeters).

The Florida Keys experiences more tropical depressions and hurricanes than any other area of the North American continent. Storms typically occur between June and November and peak in September and proximal months. Twenty hurricanes traversed Monroe County between 1900 and 1990, 11 of which were class 3 or greater (Neumann 1993). Wind effects from hurricanes can substantially affect marine as well as terrestrial structures, and the development of many reef-building species of the Dry Tortugas has been affected by winds associated with both tropical depressions and hurricanes (e.g., Knowlton and Lang 1981; Mah and Stearn 1986; Rogers et al. 1991; Wulff 1995).

AIR QUALITY

Due to the remote location of the park (about 70 miles west of Key West) and year-round winds, the air quality is not significantly impacted by external land-based pollution or airborne contaminants (e.g., urban or industrial pollutants, power generating pollutants, dust, etc.). There is no source of airborne pollution at or near the Dry Tortugas. It has been hypothesized that airborne dust particles from the Sahara Desert may be providing a source of nutrients and iron to places as far away as the Gulf of Mexico, but the implementation of any of the alternatives proposed in this document would have no impact on this phenomenon. In addition, this possible external source of nutrients has not been scientifically validated.

SOILS

The Dry Tortugas is the westernmost extension of the oolitic facies of the Miami limestone (Hoffmiester 1974). No sources were found indicating that a soil analysis has been performed at the park. A detailed analysis of soils from Monroe County is available from the Natural Resources Conservation Service, including Key West. No management action proposed in any of the alternatives would impact soils.

PRIME AND UNIQUE FARMLANDS

The U.S. Department of Agriculture defines prime farmland as the land that is best suited for food, feed, forage, fiber, and oilseed crops; unique farmland produces specialty crops such as fruit, vegetables, and nuts. According to an August 11, 1980, memorandum from the Council on Environmental Quality, federal agencies must assess the effects of their actions on soils classified by the Soil Conservation Service as prime or unique. According to the U.S. Department of Agriculture, Natural Resources Conservation Service's definition of prime farmlands, the land of the Dry Tortugas is not appropriate for prime farmland designation.

RELATIONSHIP OF OTHER PLANNING EFFORTS TO THIS MANAGEMENT PLAN AMENDMENT

U.S. CORAL REEF TASK FORCE — *THE NATIONAL ACTION PLAN TO CONSERVE CORAL REEFS*

The action plan was produced by the Working Group of the United States Coral Reef Task Force in response to its request for a cohesive national strategy to implement Executive Order 13089 on coral reefs (see appendix C). These actions were developed in consultation with various stakeholders and cover the spectrum of coral reef conservation from mapping, monitoring, management, and research to education and international cooperation. The plan calls for designating 20% of all U.S. coral reefs as no-take ecological reserves by 2010, mapping all U.S. coral reefs by 2009, and monitoring to build an integrated national reef monitoring system that profiles and tracks the health of U.S. coral reefs. Collectively, these actions are intended to provide a comprehensive road map for federal, state, territorial, and local actions to reverse the worldwide decline and loss of coral reefs. This is a living document, intended by its authors to be revisited and revised regularly, and to be augmented by agency implementation plans and an annual report from each task force member agency summarizing significant issues and accomplishments related to coral reef conservation. This general management plan amendment for Dry Tortugas National Park has been coordinated with the national initiative, and approval of alternatives B, C, D, or E would advance the two fundamental goals of the task force's action plan.

FLORIDA KEYS NATIONAL MARINE SANCTUARY — *DRAFT TORTUGAS ECOLOGICAL RESERVE SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT / DRAFT MANAGEMENT PLAN*

Dry Tortugas National Park is completely surrounded by the Florida Keys National Marine Sanctuary. The sanctuary is part of the National Oceanic and Atmospheric Administration, Department of Commerce. This agency creates and adopts management plans for the sanctuary. The Marine Sanctuaries Division of the National Oceanic and Atmospheric Administration working in cooperation with the state of Florida and the Gulf of Mexico Fishery Management Council proposes to establish a 151-square-nautical-mile no-take ecological reserve in the remote westernmost portion of the Florida Keys National Marine Sanctuary. A *Draft Tortugas Ecological Reserve Supplemental Environmental Impact Statement / Draft Management Plan* is being closely coordinated with this NPS *General Management Plan Amendment / Environmental Impact Statement* and will address only the proposed boundaries and regulations for the Tortugas Ecological Reserve, which is within the sanctuary. The ecological reserve concept was presented in the sanctuary's initial *Draft Environmental Impact Statement* as a technique to restore and protect natural spawning, nursery, and permanent resident areas for marine life, and critical habitats not already protected by fisheries management regulations.

All aspects of planning by the sanctuary and the National Park Service have been coordinated, including the involvement of the local and national publics. Although these agencies have different and distinct missions and responsibilities, it is recognized that the resources being managed are inextricably linked. Therefore the actions of one agency will affect the effectiveness of the other agencies' actions. It is the intent of both agencies that the plans and subsequent management of the park and the sanctuary complement and support each other.

GULF OF MEXICO — *REEF FISH FISHERY MANAGEMENT PLAN*

The Gulf of Mexico Fishery Management Council is amending their *Reef Fish Fishery Management Plan* to propose as a preferred alternative — the permanent closure to fishing of the Tortugas South area and the portion of Tortugas North in the council's jurisdiction. Also, the state of Florida is drafting fishing regulations to prohibit fishing in those portions of Tortugas North that are within state waters. Combined, these proposed actions will result in comprehensive protection for habitats from shallow to deep water extending from the park into sanctuary waters and Gulf of Mexico Fishery Management Council waters.

SOUTH FLORIDA ECOSYSTEM RESTORATION TASK FORCE — *STRATEGIC PLAN*

The interrelationship of and balance between the natural and built environment in South Florida has been the subject of much planning and manipulation throughout the 20th century. For example, less than 50% of the original wetlands of the Everglades remain after canalization to make more land available to agriculture and development. Much of this manipulation has been found to have had a detrimental impact on the complex natural systems upon which much of the South Florida region depends. The latest planning initiatives include the restoration of these previously disturbed water flows and correcting the subsequent decline of many natural elements and systems that depend on them. These initiatives include more than 34 federal, state, and tribal organizations, 16 counties, and more than 100 cities. The National Park Service and its four south Florida units have been centrally involved. The coordination of all of these planning efforts is the responsibility of the South Florida Ecosystem Restoration Task Force.

NATIONAL PARK SERVICE — *COORDINATED SOUTH FLORIDA FRAMEWORK*

Dry Tortugas National Park is but one of four national park system units in the South Florida ecosystem, the others being Everglades National Park, Big Cypress National Preserve, and Biscayne National Park. These four park units are managed in a coordinated way. The National Park Service developed a joint *"Coordinated South Florida Framework"* for the four parks. The goals of this framework are included in appendix B.

The management of the Dry Tortugas is by the same staff as manages Everglades National Park. However, Dry Tortugas National Park shares more resource characteristics with Biscayne. The coral reef system that lies within Dry Tortugas is the southernmost extent of the same track as found in Biscayne, which is it's the reef system's northernmost extent. Planning for the health of this reef system is done through coordinated management in the two parks.

STATE AND LOCAL PLANS

The park lies within Monroe County, Florida. However Monroe County does not have land use jurisdiction in or near the park because the only dry land in the vicinity is in federal ownership. The state of Florida has jurisdiction over submerged lands not in federal ownership. Where that may occur within the boundary, coordination with the state on those lands and the resources in them is done through the Florida Department of Environmental Protection. State and county health regulations do apply and the park must comply with the standards of those entities for water and wastewater.

RULEMAKING

A rule (also called a regulation) is a document published in the *Federal Register* to implement or interpret law or policy. A rule is generally published first as a proposed rule and receives comment from the public. It is then published as a final rule. Once a rule is published in final, it is codified in the *Code of Federal Regulations* and remains in effect until it is modified by publication of another rule.

Following the completion of the *Final General Management Plan Amendment*, rules would be published that would regulate certain activities as directed by the final plan. Activities that could be regulated within the research natural area would include:

- recreational fishing
- private boat use including bare boat charters
- research
- diving and snorkeling

Other areas that could require rules include the parkwide permit system and establishing special protection zones.

Proposed rules that result from the *Final General Management Plan Amendment* will be published for public review as a next step of the implementation process. Public comments that are received on the *Draft General Management Plan Amendment* that address topics that will be the subject of rulemaking will also apply to the public review of the draft regulations when they are released for public comment. This will save the public time by not having to send comments on the proposed rules that they felt were sent during review of the *Draft General Management Plan Amendment.*

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

THE PROPOSED ACTION AND THE ALTERNATIVES

In this section a proposed future direction for Dry Tortugas National Park (alternative C, the proposed action) is described along with four alternatives, including one that describes a continuation of existing conditions (alternative A) and serves as a basis for comparison.

Before the proposed action and alternatives were developed, information on park resources, visitor use, and visitor preferences was gathered and analyzed. Information was solicited about the issues and the scope of the project from the public, government agencies, and special interest groups through newsletters, meetings, and personal contacts. Based on the park purpose and significance and public comments, the planning team identified the resource conditions desired and a range of appropriate visitor experiences or opportunities for various areas in the park. The development of four preliminary concepts (alternatives B-E) for the park's future presented in this document was the result. All four concepts were intended to support the park's purpose and significance, address issues, avoid unacceptable resource impacts, respond to public wishes and concerns, and meet the park's long-term goals. An evaluation process called "choosing by advantages" was used to evaluate and compare the alternatives and to develop a preliminary preferred alternative.

Alternative A, the no-action alternative, describes the continuation of existing conditions. Alternative B manages for increased protection of resources under existing management zoning and within current authorities. Alternatives C and D provide for a research natural area zone (the basis for which is described in the next section) in two different, limited geographic locations in the park, and alternative E presents a research natural area zone throughout the park except at Garden Key and central Loggerhead Key. The research natural area zones in alternatives C, D, and E emphasize resource protection and the management of visitor use through a permitting system and structured activities. Fishing would be prohibited in any areas designated as research natural area zones.

Because so much in the alternatives depends on the application of management zones, the following section provides background for developing the zones and more detailed information on the research natural area zone in particular.

Some Definitions
Private boats are defined as those owned or rented by an individual. Rented boats with a hired captain and/or crew would be considered commercial and are not included in this category. The same is true for aircraft. **Commercial vessels/aircraft** include any mode of transportation for which the passenger is charged a fee and which is operated primarily by commercial staff. **Anchorages** are where boats would anchor or moor while visitors snorkel or dive to nearby resources. Overnight anchorage would be within the historic preservation/adaptive use zone. **Commercial Services** is an umbrella term that encompasses any service in a park that involves the exchange of money. The two main types of commercial services at most parks are authorized by concession contracts and commercial use authorizations.

Some Definitions (cont.)
Concessions are authorized by a legal contract requiring that specific services and/or facilities be provided to visitors. For the exclusive right to provide services and facilities, the concessioner pays the government a predetermined franchise fee on an annual basis. Contracts contain operational, maintenance, and environmental plans that detail what the concessioner is required to do. The business activities (charging fees, advertising etc.,) of a concession can occur within the park. Concessioners are often, but not always, assigned land and/or facilities within the park. **Commercial Use Authorizations** (**CUAs**) are used to permit appropriate commercial activities within a park that start and finish outside the park. All business activities must occur outside the park. No land or facilities can be assigned to the operator. Activities cannot conflict with activities authorized in a concession contract. Commercial use authorizations used to be called **incidental business permits (IBPs)**.

BACKGROUND FOR DEVELOPING THE MANAGEMENT ZONES

INTRODUCTION

Congress gave very clear direction for managing the park in the enabling legislation for the park (Public Law 102-525). Specifically the law states that:

> The park shall be managed for the following purposes among others:
>
> (1) To protect and interpret a pristine subtropical marine ecosystem, including an intact coral reef community.
> (2) To proactively manage populations of fish and wildlife, including loggerhead and green sea turtles, sooty terns, frigate birds, numerous migratory bird species, and other sensitive species.
> (3) To safeguard the pristine natural environment of the Dry Tortugas group of islands.
> (4) To protect, stabilize, restore, and interpret Fort Jefferson, an outstanding example of 19th century masonry fortification.
> (5) To preserve and protect submerged cultural resources.
> (6) Provide opportunities for public enjoyment and scientific research in ways consistent with the park purpose.

It is rare in the Park Service to have been given such clear direction from Congress on the management of resources within a national park. In the past the park has had two advantages in meeting these mandates from Congress. First there has been a long and rich history of research in the area, especially through the Carnegie Institution based on Loggerhead Key (see the discussion on Loggerhead Key in the "Affected Environment" section). As a result, much is known about the ecological resources at the park. Second, the remoteness of this cluster of islands has, until recently, spared the resources found there the dramatic damage from human uses seen elsewhere. Damage caused by overfishing and destructive fishing practices, and by the collection of and inappropriate contact with the coral, is observed throughout the Caribbean, but is limited at the park. Anchor damage to corals and sea grass beds can be identified but is not of the magnitude of impacts found in places like Florida Bay or the Virgin Islands.

Serendipitous protection due to the remote location is no longer a certainty. The Dry Tortugas have been discovered, and the word is out. Boats are bigger. More people can afford private boats or chartered tours. There is money to be made selling trips. The Park Service has examined the impacts from human use and extrapolated from them and studies made elsewhere the impacts likely to occur given anticipated visitation increases. Current management strategies at the park would make it difficult to fulfill the congressional direction of protecting the park's resources with the anticipated increasing visitor numbers.

In the following section, management zones are described, along with alternative ways of applying them to fulfill the purpose of the park — to protect the resources for the reasons Congress stated. Three of the management zones are updated versions of zones in place at the park at this time. A fourth, the research natural area (RNA) zone, is based on NPS *Natural Resources Management Guidelines* (NPS-77) (see the "Servicewide Laws and Policies and Special Park Mandates and Agreements" section). The objectives stated in the policy guidelines for research natural areas are to

1. preserve a wide range of undisturbed, representative areas that typify important ... natural situations, that have special or unique characteristics, or provide outstanding examples

of geological, biological, or ecological processes of scientific interest and importance;
2. preserve and maintain genetic diversity;
3. protect against environmental disturbance;
4. serve as reference areas for the study of ecological succession;
5. provide student and professional education;
6. serve as baseline areas for measuring long-term ecological changes; and
7. serve as control areas for comparing results from manipulative research.

This policy echoes guidance and management objectives being used internationally in the protection of rare, unique, or imperiled marine resources and ecosystems. Other similar protection strategies being used are called ecological reserves and marine protected areas. In the following discussion, the term research natural area is used to describe all of the similar strategies. The discussion describes how the protection strategy is being applied and what results are being observed.

BACKGROUND ON RESEARCH NATURAL AREAS

Authority for establishing research natural areas is provided by the NPS Organic Act of 1916. The use of research natural areas/ ecological reserves/marine protected areas has recently gained scientific and public support as a means to (1) mitigate the negative effects of fishing, and (2) provide sanctuaries for the recovery and sustainability of fish stocks, the restoration of natural habitat quality, and the conservation of marine biodiversity (Plan Development Team 1990). Many other potential positive effects have been postulated (Bohnsack 1993; Bohnsack and Ault 1996); also, research natural area zones/reserves may

- ensure adequate quantity and quality of genetic material
- maintain or increase fishery yield
- eliminate accidental catches in shrimp trawls (sometimes called "by-catch mortality " or "accidental catch mortality")
- allow for population to rebuild and provide insurance against population collapse
- facilitate scientific studies
- simplify enforcement
- protect sensitive habitats
- foster ecotourism and education

Because research natural areas can provide multiple benefits, they are being established for a myriad of reasons and goals. The goals of a research natural area should be determined before establishment, and a monitoring program should also be initiated to assess the impact of establishing the area over time. (See the management zone descriptions later in this chapter to understand the goal for the park's research natural area zone.)

Research natural areas provide excellent protection to the natural habitats through restricting human use and minimizing the impacts of uses that are allowed. How well a research natural area protects the underwater (benthic) habitat depends on the types of invasive human activities allowed within the research natural area borders. The fundamental ways that reserves may benefit reef fish stocks and fisheries is through the increase in abundance and size of individuals within the research natural areas. In turn, this increase in population abundance and size can benefit local fisheries through the export of larvae and juvenile and adult fish into less protected areas.

Numerous studies have shown a positive correlation between research natural areas and increases in abundance and size of protected populations. Russ and Alcala (1996a, 1996b) found that the average number of large predators correlated with the number of years of reserve protection for two reefs within the Apo Reserves in the

Philippine Islands. Several other studies have also shown that grouper densities increased in research natural areas versus nonprotected areas (Alcala 1988, Clark et al. 1989, Russ and Alcala 1989). DeMartini (1993) concluded from the results of simulation that reserves can enhance the number and size and spawning populations of species, showing fast growth and relatively low bidirectional migration rates.

A potential result of the increased abundance and sizes of individuals within research natural areas is the emigration of these individuals out of the reserve into local fishing areas. A study conducted at the De Hoop Nature Reserve in South Africa showed that catch rates increased for six out of 10 species studied, with increases of up to 400 % to 500% for two of the species (Bennett and Attwood 1991). Research conducted in the Sumilon Island Reserve in the Philippines showed that the fishery yields in areas surrounding a reserve increased after the reserve was established and that the authors concluded that spillover of adult fish from the reserve was the best explanation for this increase (Alcala and Russ 1990). The results of a study on the range of movement of a large predator on Heron Reef, Australia, were consistent with the theory that reserves can enhance neighboring fisheries through adult emigration (Samoilys 1997). The number of fish that swim into adjacent fished areas will depend on factors such as the species home range and movement rates, as well as reserve boundaries that intersect desirable habitat to allow for movement out of the reserve.

Research natural areas may also increase the larval production in the protected area and the subsequent dispersal of larvae to areas outside the protected area. Many commercially important species have geometric increases in egg production as size increases. For example, one 61-centimeter red snapper produces as many eggs as 212 females that are 42 centimeters long (Grimes 1987); thus, allowing individuals to grow to larger sizes will dramatically increase population larval output. Research conducted on the dispersal rates of a species (the teleost) in the De Hoop Research Natural Area in South Africa implied that the emigration of juveniles out of the reserve was restocking exploited adjacent areas (Attwood and Bennett 1994). Larvae moving to other places may counteract the effects of overfishing in those other places (Carr and Reed 1993, Russ et al. 1992). A simulation study done by Holland and Brazee (1996) indicated that for moderate to heavily fished fisheries, research natural areas can sustain or increase yields. Another study showed that the use of research natural areas can lead to substantial increases in the size of the spawning stock when fishing mortality rates are high (Polacheck 1990).

The marine environment, particularly a reef ecosystem, is extraordinarily complex, and complete understanding and predictability of such a system may never be possible. In the face of such uncertainty, research natural areas provide a safety net to reduce the risk of a fish stock collapse in the face of overfishing or uncertain management decisions (Lauck et al. 1998; Bohnsack 1998). Based on findings that the Florida Keys contain many large reef fish species that are currently heavily fished or overfished (Ault et al. 1998), the park should be an ideal environment for the use of research natural areas to improve the state of the reef fish fisheries.

Mathematical programming, optimization, and simulation-based research conducted by Meester (2000), which is discussed in more detail later in this document, showed that the effectiveness of research natural areas in protecting reef fish stocks depended on several critical factors — the movement strategies employed by a species of fish, as well as its growth rate and natural mortality rate. The fishing mortality rate both before research natural area establishment and in nonprotected areas after establishment is also important.

MANAGEMENT ZONES

Management zones prescribe what specific resource conditions and visitor experiences would be achieved and maintained in each particular area of the park under each of the action alternatives (alternatives B–E). (Alternative A's management zones, which are similar to these zones, would remain the same as those in the 1983 management plan.) Ideas for the range of zones came from the park staff and the public in the scoping phase. They are grounded in the park's purpose, significance, and mission goals. In formulating alternatives for future park conditions and management, these zones were placed in different locations or configurations on the map to align with the overall intent (concept) of each of the alternatives. That is, the management alternatives represent different ways to apply the four management zones to the park.

Each zone specifies a particular combination of physical, biological, and social conditions, the types and levels of visitor use desired, and the amount of manipulation of the natural or cultural setting that would be appropriate to support those conditions and uses. Each zone also calls for a level of management or enforcement to maintain the desired conditions for that zone. Four distinct management zones were developed.

HISTORIC PRESERVATION/ ADAPTIVE USE ZONE

In an area managed as historic preservation/ adaptive use, visitors would be immersed in a built environment that is rich in architectural and cultural history. Interpretive and educational opportunities would be greatest in this zone, and opportunities would exist to experience both natural and cultural resources. Visitor activities would often occur in a structured manner (such as guided tours). The probability of encountering other people and NPS staff would be moderate to high. but at certain times of the day or season opportunities would exist to experience solitude and quiet. Opportunities for challenge and adventure would be low to moderate in this zone. At all times, visitors would be encouraged to act in a manner that respects others' use and enjoyment of the park. Visitors should expect moderate intrusions to the natural soundscape by boats, planes, mechanical systems, and other people. (This zone would have the same configuration for alternatives B–E and is detailed on the map shown in alternative B.)

The setting within this zone would be predominantly historic, and the integrity of significant historic resources would not be compromised. The historic scene and the land and marine natural features would be managed to maximize their integrity and to support visitor use. Some aspects of the natural and cultural landscape would be modified (e.g., site hardening, landscaping, and restoring disturbed areas) to protect resources and accommodate use. Nighttime light levels would remain low so that visitors could enjoy the impressive night skies.

Appropriate visitor activities could include learning about the park's natural, cultural, and human history and its ecological and historical relevance, birdwatching, photography, walking, picnicking, swimming, snorkeling, scuba diving, camping, boating, and recreational fishing. Some of these activities could be provided by commercial operators. A range of interpretive, educational, and orientation programs would be provided, with orientation and interpretation of resources taking place mostly onsite.

To support a wide range of activities and higher concentrations of visitors, there would be more visitor services than in any other zone, but food service and fresh water would not be available. Facilities within this zone could include visitor contact facilities, restrooms, exhibits, and facilities related to park administration and operations. Also included could be self-guiding trails, mooring and navigation buoys, primitive campgrounds, and picnic areas.

The management focus in this zone would be on maintaining and protecting historic resources, maintaining visitor facilities, mitigating impacts from human use, and providing for quality visitor experiences. Evidence of management activity and resource preservation could be visible to visitors.

NATURAL/CULTURAL ZONE

In areas of the park managed as natural/ cultural, maintenance or improvement of resource quality would be emphasized but visitors would be free to move about the zone with few restrictions. The surroundings would offer a sense of remoteness and peace in a vast expanse of sea and sky. The land, sea, and soundscapes would be predominantly natural with minimal signs of human intrusions. Visitors would generally expect to find solitude. There would be the expectation that other individuals or small groups would sometimes be encountered, but concentrations of use would be low and visual and soundscape intrusions would be minimal. Opportunities for challenge and adventure would be relatively high compared to other zones, and boaters would need to be self-reliant and have good marine and navigational skills.

The natural scene would remain largely intact, with natural processes predominating. There would be little lasting evidence of recreational impacts, and most management actions would be devoted to protecting resources, minimizing or preventing impacts from visitor use, enhancing visitor safety, and restoring disturbed areas.

Facilities would generally not be appropriate; however, interpretive signs might be appropriate in certain cases. Minor alterations to the natural environment (such as buoys and signs used for resource protection, interpretation, and visitor safety) would be allowed.

Appropriate activities would include snorkeling, scuba diving, swimming, boating, wildlife viewing, and recreational fishing. Some of these activities could be provided by commercial operators. Visitors would be free to pursue activities with generally few restrictions as long as high levels of resource protection, resource quality, and visitor experience exist.

Most information and orientation would be received elsewhere, such as at the fort and before entering the park, although some information and interpretation might be given to visitors during tours within the zone.

RESEARCH NATURAL AREA ZONE

Research natural areas would be established in areas of outstanding and important resource value in order to protect the physical structure of habitats and ecological processes. In Dry Tortugas, research natural areas would protect a representative range of terrestrial and marine resources that would ensure protection of spawning fish stocks and fish diversity and to protect near-pristine habitats and processes to ensure high-quality research opportunities.

Research natural areas would be representative of the park's near-pristine, intact ecosystems (islands, deep and shallow coral reefs, sea grass beds, sand, and hard bottom [type of resource on the sea floor]). Visitor travel and behavior within the zone would be highly controlled to maintain the highest levels of resource quality. This zone would provide baseline areas for measuring long-term ecological changes. Within research natural areas the natural land, sea, and soundscapes would predominate. The areas would be managed to provide the greatest possible protection of resource integrity. They would be set aside permanently and managed for approved nonmanipulative research (research that measures but does not alter the existing condition), and natural processes (e.g., ecological succession) would be allowed to occur without disturbance or impacts from humans.

There would be no lasting signs of recreational use, and no manipulation of natural or cultural resources would be permitted (except those aimed at restoring natural conditions or preserving special cultural resources). There would be extremely low tolerance for resource degradation or disturbance. The preservation and maintenance of biological and genetic diversity would be an important objective. Research natural areas would offer outstanding opportunities for scientific research and learning about natural systems, and public education and interpretation would be important activities in this zone. Visitors would experience a sense of remoteness and peace in a vast expanse of sea and sky. Areas and resources would be interpreted so that visitors could understand the reasons for establishing the research natural area.

There would be a low to moderate expectation of seeing NPS staff, and a high expectation of encountering commercial guides. There would be a low expectation of encountering other tour groups, and tour group sizes would be small. Under certain conditions chances would exist to experience solitude, tranquility, quiet, and to view rare or sensitive species.

Activities occurring within a research natural area would be restricted to non-manipulative research, education, and other activities that do not detract from the area's research values. Nonconsumptive activities, such as wildlife viewing, snorkeling, sightseeing, boating, photography, and diving, would be managed so that resources would not be degraded. Recreational fishing and other consumptive activities would not be allowed. Boats would be allowed only at designated mooring buoys. No anchors would be allowed.

Most development and facilities would not be appropriate, but signs, mooring buoys, and scientific research equipment such as site markers or small sampling devices would be permitted. For further information on research natural areas, see the previous "Background for Developing the Management Zones" section and the "Impacts on Natural Resources" section.

SPECIAL PROTECTION ZONE

The special protection zone would be established to provide added protection for certain exceptional and critical resources and would be managed to allow natural processes to occur without disturbance or impacts from humans — i.e., no activity, except research, would be allowed. This zone could be established to include bird and sea turtle nesting areas, areas of shallow or sensitive coral, or significant submerged cultural resources. The boundaries of the zone could be adjusted, or management could be changed, to respond to changing resource conditions. In certain cases, areas in this zone might be closed for extended periods to permit natural processes to proceed. Thus, the special protection zone is a management tool and "overlay" zone that allows protection of resources at certain times and in certain places throughout the park. For example, although the eastern shore of Loggerhead Key may be a natural/cultural zone for part of the year, when turtle nesting is taking place, this area would be zoned as a special protection zone.

Natural land, sea, and soundscapes would predominate within the zone. Lasting signs of recreational use would not be apparent, and no manipulation of resources would be permitted, except actions aimed at restoring natural conditions or preserving special cultural resources. There would be no tolerance for resource degradation or disturbance.

MANAGING FOR VISITOR EXPERIENCE AND RESOURCE PROTECTION

As described above, desired resource conditions and visitor experiences are prescribed in each management zone. These conditions and experiences would be specified in a manner that would allow them to be measured and monitored. Indicators of resource condition and visitor experiences would be developed that would reflect the overall condition of the zone and allow measurement of visitor impacts on biological, physical, and cultural resources of the park, as well as impacts on visitor experiences. Standards for each indicator would be set that establish the maximum amount of deterioration of resource or experience quality that would be allowed before management action is taken. Monitoring programs would be initiated that would measure the condition of resources and visitor experiences.

The coral reefs, shipwrecks, and birding sites of Dry Tortugas are among the various locations for visitor use in the park. Each of the types of sites are described below to indicate the condition of the site that would be acceptable in each management zone, the characteristics of visitor behavior that would be appropriate, and a preliminary estimate of the maximum numbers of visitors that would be appropriate at each site. These descriptions would form the basis for establishing detailed indicators and standards for experience and resource conditions. The process of determining how much use is too much is a dynamic one. It will require testing and adjusting management strategies over time.

A starting point was set with preliminary numbers in the table below. To develop these numbers, a group of staff and researchers who have extensive experience in managing coral reefs and have observed the relationship between visitor use and the condition of the resource was assembled to develop preliminary numbers. Then several other experts reviewed the results of their efforts. Their experience includes research in similar resources as well as the implementation of management practices elsewhere and within Dry Tortugas. The purpose of these numbers is to provide a best estimate of use so that the impacts of the management approaches in each alternative can be assessed and to estimate the feasibility of commercial service options.

The numbers below are preliminary, and because these numbers are preliminary, they are presented in ranges. Through monitoring the park staff will determine if these numbers are viable/acceptable; if not the numbers may be modified. Actual numbers for specific sites and uses would be managed to achieve the desired conditions and experiences for those sites. There will be follow-up plans such as a revised resource management plan, a visitor management plan, and a cultural resources management plan to test these numbers.

TABLE 1. HISTORIC PRESERVATION/ADAPTIVE USE ZONE

Condition	Desired Result	Preliminary Capacities
1. Picnic area Shade would be provided by native vegetation. Instructional signs would be present. Tables would be adequately spaced. Impact on natural and cultural resources would be minimal.	Large groups would be guided and informed of regulations. Groups and individuals would be controlled and quiet.	Numbers would not exceed wastewater treatment facilities' capacity: 15 tables X 6 people = 90-person capacity
2. Garden Key Orientation/information signs would be present. Adequate restrooms and change rooms would be available. Impact on natural and cultural resources would be minimal. Lighting would be adequate.	Conflicts between private boaters and tour boats would be minimal.	250–300 per day
3. Anchorage Visual impact from boats would be moderate. Natural quiet (or natural ambient sounds) would be available at night. Mooring buoys would be present. Development and activities would not affect sensitive areas.	Boat motors and music would be off at 10:00p.m. Visitors would not feel overcrowding. Groups and individuals would be self-controlled and quiet Visitors would receive information and education on-site that guides appropriate behavior	Garden Key – 80–100 boats
4. Submerged cultural resources Mooring buoys would be present. Sites would be safe for visitors be intact have educational value be hardened (no removable artifacts) have integrity	Visitors would receive information and education that guides appropriate behavior	15–20 people per site
5. Land-based cultural resources Structures would be structurally sound and safe. Integrated pest management practices would be used. Guided and self-guided trails would be available. Historical integrity and historic landscape would be maintained. No invasive exotic plant species would be present	Visitors would read, understand, and follow informational literature. Tour groups would be timed at well-spaced intervals.	20–25 people per guided tour with three groups touring fort at one time at 20 minute intervals = 60–75 at one time 30–40 individually guided visitors at same time = 90–115 total visitors at one time
6. Night sky: Nighttime light levels would be low. Appropriate illumination for navigation would be present. No light source would disorient sea turtles.	Visitors would understand the desire for nighttime experience and exhibit caution when moving about.	Night sky viewing would take place only at anchorages (80–100 boats at Garden Key and campgrounds (85 total campers/night)

Condition	Desired Result	Preliminary Capacities
7. Fishing activities Fishing regulations would be posted. Periodic opportunities for trophy tarpon by casual fishermen would be available. Reasonable opportunities for novice fishermen to catch some fish would be available.	No hooks, line, etc. would be left about unattended. There would be due regard for pelicans. Visitors who are fishing would not interfere with other visitor uses.	Six per boat
8. Turtles Not applicable to this zone.		Not applicable to this zone.
9. Natural quiet sites Natural soundscapes would predominate.	Visitors would receive education about the importance of minimizing noise levels. Noise levels would be minimized.	Not applicable to this zone.
10. Research sites	There would be no conflict between visitor use and research activities Research must have approved research plan. Visitors would receive information and interpretation about research activities.	No predetermined capacity; numbers would be regulated through research permit system.
11. Campground/sites Adequate space would be present. Instructional signs would be present. Sites would be primitive.	Large groups would be guided and informed of regulations. Groups and individuals would be controlled and quiet.	10 sites, not to exceed six people per site. One party per site one group site that would not exceed 30–40 Maximum total campers = 95–100
12. Sea grass beds Not applicable to this zone.		Not applicable to this zone.
13. Reefs Impact on corals due to snorkeling would be moderate.	Visitors would receive information and education that guides appropriate behavior before entering the water.	30–50 on south beach 20–25 on north beach
14. Birds Vegetation quality is maintained without impacting cultural resources. Migratory warbler roosting and feeding habitat is maintained.	Visitors do not harass or feed birds.	30–50 on south beach 20–25 on north beach
15. Beaches Evidence of recreational use would be minimal. Offshore coral would not be damaged by snorkelers or swimmers.	Visitors would receive education and information on appropriate behavior. Visitors would pack out all trash and waste.	30–50 on south beach 20–25 on north beach

Condition	Desired Result	Preliminary Capacities
16. Facilities (future) There would be adequate numbers of restrooms potable water wastewater treatment electrical system capacity maintenance technical staff water testing labs (state certification) dock facilities – berth and restrooms		Wastewater treatment: would accommodate the needs of 25,000 people annually 50 campers per day 200 day use visitors/day Insufficient to accommodate maximum Garden Key capacity.

TABLE 2. NATURAL/CULTURAL ZONE

Condition	Desired Result	Numbers
1.Picnic area Not applicable to this zone.		
2.Garden Key docks Not applicable to this zone.		
3. Anchorages Anchoring would be permitted except in coral and sea grass. There would be little evidence of anchor damage such as areas disturbed by dragging anchor chain or anchor-damaged coral or sea grass. Minor alterations to resources would be allowed, such as buoys and navigational aids/signs. The natural scene would be largely intact and there would be little lasting evidence of recreational impacts. Opportunities would be present for solitude, quiet, and night sky viewing.	Boaters would anchor in open area away from coral and sea grass. Visitors would receive education about anchoring before visiting park. Visitors would anchor only in designated areas (permits may be required). Visitors would not anchor at night. Visitors would anchor at safe distances from other boats, preventing collisions from swinging at anchor.	At reefs — see #13 in this table At submerged cultural resources — see #4 in this table.

Condition	Desired Result	Numbers
4. Submerged cultural resources – NPS published There would be no damage to resource – degradation would not exceed the baseline condition at the time site was opened. Sites would be safe for visitors be intact have educational value be hardened (no removable artifacts) have integrity	Visitors would be informed of resource protection requirements and penalties for disturbance. Visitors would not touch, stand, or contact resource. Dive master on commercial tours must be able to watch all the people for safety purposes.	15–20 people or less per group two groups of 15–20 per site
Other nonpublished sites There would be little or no lasting evidence of recreational use, damage/disturbance.	Location information would be provided on selective basis to researchers. Snorkeling and diving would be allowed, but visitors would not be directed to these sites. Access might be restricted for resource protection or visitor safety.	2–3 boats per site, each with 8–12 people
5. Land-based Cultural Resources – other islands (not Garden Key or Loggerhead Key) Recreation impacts would be minimal, and resources would not be degraded/damaged. All resources would be identified, documented, preserved, monitored, and interpreted, as appropriate.	Visitors would be informed of historic resource importance and penalties for disturbance. Visitors would stay off sites and would not touch or take anything.	Two-three boats per site
6.Night sky U.S. Coast Guard regulations for anchor lights would be used. There would be no unnecessary lighting; light levels would be appropriate for safety. Night sky would retain clarity for stargazing and would be unaffected by light pollution.	Visitors would be educated about value of night sky and appropriate use of lights. Visitors would use only the lights necessary for boats, safety, navigation, and anchorage. Visitors would minimize use of lights after dark.	Site dependent — see other capacities.
7. Fishing – trophy and novice There would be little evidence of damage/degradation to fish populations from trophy or novice fishing. In no case should fishing be allowed to reduce the reproductive potential of the population or to radically alter its natural (unfished) age structure.	Visitors would receive information and follow state and NPS regulations.	Recreational fishing groups would be limited to six or less (six pack). Fish watching groups would have same limits as for snorkeling/diving.

Condition	Desired Result	Numbers
8. Turtles Turtle populations and nesting success would improve over 1999 baseline condition. Turtle nests would not be disturbed by recreational use.	Only research activities and distant viewing would be acceptable. Interaction with turtles and nesting site would occur only by permit for research. Visitors would be informed of appropriate behavior around turtles and their habitat.	Guided interpretive walk group size would be limited to 10.
9. Natural quiet sites Natural soundscapes would predominate.	Visitors would observe quiet hours. Visitors would receive information about the value of natural quiet and appropriate behavior.	1–2 boats (4 to 8 people) on a small reef (less than 0.5 to 0.75 acre) 3–4 boats (12 to 16 people) on a large reef (greater than 0.75 acre)
10 Research Sites – Nonvisitor Pre-existing impacts would be documented for future mitigation and management actions. Sites would not be degraded by visitor or researcher use. Manipulative research would be allowed only to meet park management goals. Sites would be maintained in near-pristine condition to assist long-term monitoring/research objectives. There would be no visitor use or development impacts.	Researchers would have NPS research permit and adhere to permit conditions/restrictions. Sites would be closed to visitor use.	Number of research sites would be identified in the park's NPS resources management plan and the research plan for natural/ cultural/social research.
Research sites – Learning Evidence of recreational impacts would be minimal. Sites would be maintained in as unaltered a condition as possible to enhance visitor interpretation and learning opportunities.	Visitors would not interfere with research activities. Visitors would receive information and education about research on guided tours.	5–10 people or less at each site
11. Campground/sites Not applicable in this zone.		Not applicable in this zone.
12. Sea grass beds Evidence of sea grass damage from anchoring, prop dredging, and snorkeling would be minimal.	Visitors would not anchor sea grass beds. Visitors would not operate boats in water shallow enough to have prop dredging.	Capacity would be established by associated resource (e.g., reef).

Condition	Desired Result	Numbers
13. Reefs		
0′–6′: There would be no evidence of recreational impacts: • No evidence of trampling • No damage from anchors • No damage from boat groundings. • No damage from pollution • No broken coral	There would be no visitor use on these shallow reefs	None
7′–15′: Evidence of recreational impacts would be minimal. There would be minimal impact from trampling, touching, anchoring, or boat groundings.	Visitors would not touch, kick, or stand on coral. Visitors would not anchor on coral.	two–three boats in small area four–five boats in large area group size: 10 or less
16′ +: Evidence of recreational impacts would be minimal. There would be minimal impact from trampling, touching, anchoring, or boat groundings.	Visitors would not touch, kick, or stand on coral. Visitors would not anchor on coral.	
	ALL DEPTHS: Visitors would be instructed to anchor in designated/ acceptable areas. Divers and snorkelers would be instructed in resource protection techniques and objectives. There would be a strong educational emphasis to prevent coral damage.	
14. Birds All bird populations would be maintained with optimal reproductive viability.	Visitors would not feed or harass birds.	30–50
Nesting Nesting habitat would be maintained and enhanced. There would be no impacts from recreation.	At nesting sites, recreational observation would take place from the water only. Visitors would be informed about protecting critical habitat and not disturbing nesting colonies.	
15. Beaches Sea turtles nesting areas would not be disturbed. Beach areas would be clean and free from debris.	East Key and Loggerhead beaches would be closed at dark. Visitors would understand and respect the need for clean/clear beaches to ensure sea turtle nesting opportunities. Boats would not be present.	15–20 people per 100 linear feet of beach per day.
16 Facilities Not applicable to this zone.		

TABLE 3. RESEARCH NATURAL AREA ZONE

Condition	Desired Result	Numbers
1. Picnic area Not applicable to this zone.		
2. Garden Key docks Not applicable to this zone.		
3. Anchorages There would be no impact on the environment.	No anchoring allowed; visitors only use designated mooring buoys.	See capacities for types of sites.
4. Submerged cultural resources There would be no evidence of human-caused degradation.	Visitors would access sites only by guided tours (alternatives D and E only). Visitors would use designated mooring buoys. Visitors would be informed of resource protection requirements and penalties for disturbance. Visitors would not touch, stand, or contact resource. Dive master on commercial tours would be able to watch all the people for safety purposes.	15–20 at one time/site
5. Land-based cultural resources There would be no evidence of site degradation.	Visitors would access sites only on guided tours (alternatives D and E only). Visitors would be informed of historic resource importance and penalties for disturbance as appropriate. Visitors would stay off of sites and would not touch or take anything.	1–6/site
6. Night sky There would be no unnecessary lighting; light levels would be appropriate for safety. Ability to stargaze would be unaffected by light pollution.	Visitors would see night sky only on guided tours (alternatives D and E only).	NA
7. Fishing Not applicable to this zone.		
8. Turtles There would be no tolerance for impacts.	Visitors would not interfere with turtles or nesting sites and would receive information about appropriate behavior around turtles and their habitat.	None at nesting sites.
9. Natural quiet sites Natural soundscapes would predominate.	Visitors would receive information about the value of natural quiet and appropriate behavior.	One–two boats (four–eight people) on a small reef (less than 0.5 to 0.75 acre) three–four boats (12–16 people) on a large reef (greater than 0.75 acre)

10. Research sites – nonvisitor Pre-existing impacts would be documented for future mitigation and management actions. Sites would not be degraded by researcher use. Manipulative research would not be allowed. Sites would be maintained in near-pristine condition to assist long-term monitoring/ research objectives. There would be no visitor use or development impacts.	No visitor use would be allowed.	
11. Campground/sites Not applicable to this zone.		
12. Sea grass beds: Sea grass beds would not be impacted by human use.	There would be no anchoring in sea grass beds.	None
13. Reefs		
0′–6′ There would be no evidence of recreational impacts: • No evidence of trampling • No damage from anchoring • No damage from boat groundings • No damage from pollution • No broken coral	There would be no visitor use on these shallow reefs.	Two–three boats per reef, group size six or less
6′–15′: There would be no evidence of recreational impacts.	Visitors would not touch, kick, or stand on coral. Visitors would access sites only by guided tours and with permits (alternatives D and E only).	up to 15–18 per site
15′+ There would be no evidence of recreational impacts.	Visitors would not touch, kick, or stand on coral. Visitors would access sites only by guided tours and with permits (alternatives D and E only).	up to 15–18 per site
	ALL DEPTHS: Divers and snorkelers would be instructed in resource protection techniques and objectives. There would be a strong educational emphasis to prevent coral damage.	
14. Birds All bird populations would be maintained with optimal reproductive viability. **Nesting** Nesting habitat would be maintained and enhanced. There would be no impacts from recreation.	At nesting sites, recreational observation would take place from the water only. Visitors would be informed to protect critical habitat and would not disturb nesting colonies.	30–50

15. Beaches Sea turtles nesting areas would not be disturbed. Beach areas would be clean and free from debris.	East Key and Loggerhead beaches would be closed at dark. Visitors would understand and respect the need for clean/clear beaches to ensure sea turtle nesting opportunities. Boats would not be present.	15–20 people per 100 linear feet of beach per day
16 Facilities Not applicable to this zone.		

MONITORING TO MAINTAIN VISITOR EXPERIENCE AND RESOURCE PROTECTION

To ensure that the key desired conditions (described below) remain as prescribed, monitoring would take place to evaluate resource conditions and visitor experiences. (Not all conditions listed above are key conditions.) Work would be needed following this general management plan amendment to refine the indicators, standards, and monitoring methods described below.

Anchorages

Where the use of anchors would be allowed, the damage to coral reef structures or to sea grass beds would be measured. Surveys would be conducted at specified times and places to determine the frequency of inappropriate anchoring. Park staff would contact owners of anchored boats to inform them of the monitoring activity and then use a glass window tube or snorkel/dive gear to investigate the location of the boat's anchor. If it were on coral or sea grass, measurements would be taken to determine the area of disturbance and the extent of resource damage. Indicators would be the number of incidents of improper anchorage and area of disturbance.

Submerged Cultural Resources

- Damage to exposed resources — Rapid “swim-by” surveys would be conducted to look for recent damage attributable to visitor use. A condition class rating would be developed that combines number of occurrences with severity and significance of damage. Surveys would be conducted several times/year on the most popular dive wrecks and less frequently on less popular wrecks.

- Loss of artifacts — Photography would be used to document the theft of artifacts. A condition class rating would be developed that combines the number of missing artifacts with their significance. Surveys would be completed annually for popular dive wrecks and less frequently on less popular wrecks.

Coral Reefs

- Damage to coral structures and other attached organisms — Anonymous snorkeling/diving observation surveys would be conducted by NPS staff or researchers at specific times and places with both unaffiliated and commercially led visitor groups. Visitor contact with reef organisms would be visually monitored, and the number of incidents per observational time would be recorded, e.g., three contact incidents/ 20-minute survey period. Contacts would be categorized by type of contact (i.e., standing up, fins, hands), whether contact is intentional, whether damage was done, severity of damage, etc.

- Theft of coral reef organisms — Observation surveys would be conducted as described above or at greater distances with binoculars to see if organisms were brought into boats.

- Broken corals and sea fans — A limited number of line transects could be surveyed on an annual basis to examine the number of broken corals and sea fans. This data would need to be compared to an unused control area that is environmentally similar (possibly difficult to find). The difference between measures would be attributed to visitor use.

Visitor Experience

The density of use occurring at use sites would measure the quality of the visitor's experience. Observational surveys would be conducted at specific times and places to determine the following:

- Group size — The percentage of groups observed that are more than a specified size (e.g., no more than 25% of the groups observed will be larger than 15).
- Visible groups at anchorages — The percentage of observations with the number of parties anchored at one time that exceed the prescribed standard (e.g., three parties at one time).

PARKWIDE MANAGEMENT ACTIONS

This section describes actions or the lack of actions that would be taken, in addition to the servicewide policies and mandates previously described in this document, to fulfill the park's mission goals regardless of which alternative is chosen.

TABLE 4. PARKWIDE MANAGEMENT ACTIONS, ALL ALTERNATIVES

Parkwide Management Actions, All Alternatives	
Visitor Experience	**Education/Interpretation/Information.** Opportunities for visitors to learn vary by alternative, but all alternatives would emphasize understanding and appreciating the resources of the park and the appropriate use of those resources. Studies of visitor behavior in other marine and coral reef parks has shown very positive results when visitors are given information about the effects of their behavior on park resources. After receiving information and education, visitors significantly reduce detrimental behavior such as swimming near coral in shallow water, touching or brushing against coral, or anchoring on coral. Opportunities for education/interpretation/information on topics such as resource protection would exist at Key West, Fort Jefferson, and en route to the park by commercial operator. The park would engage in additional planning to improve visitor information, facilities, and outreach programs. Visitors would be educated through a combination of nonpersonal interpretive services (exhibits, waysides, radio and television media, and publications) and personal services (daily ranger-led interpretive programs, visitor center staffing, and law enforcement monitoring. **Visitor Facilities and Services.** Visitor travel to the park would continue to be by commercial vessel or plane or by private boat.
	Most visitors would be day users, and because of time constraints, Fort Jefferson would likely remain the primary destination site. In addition to touring the fort, other recreational opportunities would include snorkeling, scuba diving, boating, swimming, camping, and wildlife viewing. (Fishing opportunities would vary between alternatives, but under all alternatives recreational fishing would be allowed at Garden Key.) Because of physical and operational constraints, and to maintain the near-pristine resources and sense of remoteness important to fulfilling the purpose of the park, visitor services and facilities would remain much as they are today. Visitors would need to be self-sufficient and provide their own food, water, equipment and other supplies. An interagency visitor facility would be established in Key West under all alternatives (a visitor contact facility in Key West was called for in the 1983 *General Management Plan*). The agencies participating would be the Florida Keys National Marine Sanctuary, the National Park Service, and the U.S. Fish and Wildlife Service. It would have general park information and interactive exhibits and give potential visitors pre-visit information to make their experience more meaningful and help them be better prepared for the trip, including transportation information. The visitor facility could also serve as an alternative to visiting the park. The center would also provide information and exhibits about the Florida Keys National Marine Sanctuary and national wildlife refuges in the Florida Keys and help visitors plan ways to visit and enjoy these areas. The three agencies would share staffing responsibilities and would jointly plan and coordinate the stories to be told and the exhibits and programs to tell them. The visitor center staff would also coordinate information dissemination to the Chamber of Commence, the Internet, and other travel information sources. The Loggerhead Key facilities, including the dock, would remain for administrative and research use; they are not for general visitor use and that situation would continue in all alternatives due to safety and capacity restraints on the dock and staff on the island.

	The visitor center at Fort Jefferson would be expanded into one or two additional casemates to support recommendations of a new interpretive plan that would be developed after adoption of this management plan. The new plan will expand interpretation to address all the management objectives in the park's enabling legislation. No other adaptation of historic buildings or expansion into the historic landscape would occur to support visitor use.

Parkwide Management Actions, All Alternatives	
Resource Protection	**Natural Resources** The establishment of an ecological reserve adjacent to the park by the Florida Keys National Marine Sanctuary would be supported under all alternatives. The night sky in this remote location would remain unpolluted by man-made light sources as much as possible. This rare opportunity to see the pristine night sky would be protected under all alternatives. The natural soundscape — that is the sounds of nature absent man-made intrusions on them — would be protected under all alternatives. Management will include the following actions: ▪ Identify intruding noise sources. ▪ Identify and implement mitigation or prevention measures. ▪ Educate persons responsible for intrusive noises to change their behavior or practices. **Cultural Resources** Historic preservation/adaptive use zone areas would remain in effect for Garden Key (Fort Jefferson) and the central portion of Loggerhead Key. **Research** Supplemental support for research being done on the Dry Tortugas region, such as storage, would be established in Key West. This might be in conjunction with the staff office space mentioned in the "Park Operations" section. At a minimum this support would include boat dock space, offices, temporary housing, a laboratory, compressors for dive tanks, and storage space. It would constitute an offsite station for work within the sanctuary and the park. This support and facilities would not accommodate full-time permanent staff. Some Loggerhead Key structures would be adaptively used as a modest support base for research in the park and the Florida Keys National Marine Sanctuary. This research facility might evolve into a research institute, similar to the Carnegie Institution formerly on Loggerhead Key. Facility needs beyond what was available on Loggerhead Key would be self-contained and would not place any burden on park resources or facilities. Such facilities might include a floating facility temporarily located within the park boundaries. In-park research processing would occur at Loggerhead Key or on vessels.

Parkwide Management Actions, All Alternatives	
Park Operations and Facilities	Current patrol boats and the *Activa* (the NPS supply boat that makes weekly trips to the park from Key West) would continue their operations under all alternatives. Existing Key West dock space for the *Activa* would be maintained under all alternatives. The pier and storage structure across from the *Activa* dock space would be the subject of an agreement between the National Park Service and the Coast Guard to allow the National Park Service to use the area for storage. Besides space for storage, there is also a need for office space in this general vicinity. In all alternatives, office space would be sought. Offices might be with the sanctuary and the U.S. Fish and Wildlife Service. Decisions about this space should consider the interagency visitor facility (mentioned under "Visitor Experience" above) as one possible solution.

Park Boundary and Buoy System

The park boundary is marked with buoys, and there are other navigational aids throughout the park. (Some alternatives include additions to the buoy system to delineate zone boundaries and use sites and protect resources.)

Boundary Adjustments

Because the park boundary is adequate to support park purposes, no boundary adjustments are proposed in any of the alternatives.

Housing

Existing permanent and temporary employee housing within the casemates would be upgraded with energy-efficient inserts that do not further degrade the historic walls of the casemates. No additional casemates would be converted into housing or modified to accommodate administrative uses. As staff increases in number, which would occur to varying degrees in any alternative, a new strategy for some of the personnel would be adopted. It would rely on permanent housing ashore, with personnel rotating to the park into shared temporary housing for tours of duty. Researchers and other staff from agencies who are doing research that supports the park purpose would be accommodated within the modified casemates for the term of their needs as space permits.

No other staff, e.g., concessioner staff, would be housed within the park.

Visitor Center

The visitor center would be expanded.

Utilities

Utility capacities would not be expanded unless technological improvements make such expansion feasible. Renewable energy sources such as photo voltaic and geothermal would be pursued to replace petroleum for water heating and air conditioning. The reliance on petroleum for electric generation could be reduced further by managing load distributions during the day and meeting electric demand at night with battery storage. Renewable energy should be pursued to replace diesel electric generation on Loggerhead Key and reduce fossil fuel consumption on Garden Key.

Communication Systems at the Park

Management would continue to explore new technologies to improve communications, with an emphasis on improving visitor information and visitor safety.

Necessary and Appropriate Commercial Activities

Without commercial transportation most visitors would not be able to access or experience Dry Tortugas National Park. Because of the logistics and costs involved it is the most effective and efficient means for the average national park visitor to access the park. Without commercial transportation the park mission goals of educating the public and offering a quality recreational experience could not be achieved. Commercial transportation also reduces the number of vessels traveling to and within the park and the associated resource impacts, much the same as mass transit systems in other parks. For these reasons commercial transportation to the park is a necessary activity and is included in each alternative. However, there is a need to manage this activity within the capacity of the resources to withstand use.

ALTERNATIVE A: CONTINUE CURRENT MANAGEMENT (NO ACTION)

ALTERNATIVE A =				
The servicewide mandates and policies	+	The parkwide management actions	+	The actions described below that support the concept for this particular alternative

OVERALL CONCEPT

This alternative describes a continuation of current management and trends (see Alternative A map). Note that the management zones defined on this map are from the 1983 management plan and are therefore different than the management zones described for alternatives B–E. If the no-action alternative were selected, the park staff would try to accommodate visitor use while also protecting park resources according to current policy and legal requirements. The open access policy for visitation would continue within the constraints of current funding and staffing levels. Visitation would be expected to rise as commercial use authorization holders use larger vessels (up to 100 passengers) and private boaters increase in number. Increases would be limited or controlled only on an ad hoc basis in response to degrading resource conditions, crowding, or facility limitations.

VISITOR EXPERIENCE

Under this alternative, commercial operators would continue to provide transportation to the park, but there would be very limited intrapark transportation. Most of these intrapark opportunities would be offered through guide services obtained offsite, e.g., in Key West. Consequently tour visitors would participate primarily in activities that occur at Fort Jefferson on Garden Key. Because of travel restraints, there would be a low level of challenge and adventure and little chance for quiet and solitude.

There would be no restrictions on private boaters' destinations or activities throughout the park except in special protection zone areas. Anchors could continue to be used throughout the park during the day, and at night all boats within park boundaries must be anchored or moored within the historic preservation/adaptive use zone around Garden Key. Use of the dock on Loggerhead would continue to be prohibited, however anchoring and swimming ashore would be permitted. Private boaters could expect to find challenge, adventure, and quiet and solitude. Visitors with a private boat or a guide hired offsite would have access to the offshore coral reefs, shipwrecks, and keys other than Garden Key.

Visitors could choose from a variety of unstructured or self-initiated activities, depending on what equipment they rent or bring, with few limitations on the type of allowed activities. Although visitors would expect a moderate to high level of staff and social encounters in historic preservation/adaptive use zone areas such as Garden Key, they would still experience a feeling of remoteness and peace in most of the park. Recreational fishing with the necessary state license would be allowed throughout the park under this alternative.

Fort Jefferson would remain the focal point for visitor orientation. Interpretation of the fort and marine resources would continue, but ranger-guided tours would remain limited. There would be little opportunity for private boaters to receive information and orientation other than at the fort, but tour visitors would have additional opportunities through commercial operators at Key West and en route to Garden Key.

RESOURCE PROTECTION

Cultural and natural resources would continue to be managed as time and funding allow according to the park's resources management plan. Resources would be managed to allow natural processes to predominate, with management actions limited to those measures needed to protect resources or ensure visitor safety.

With few restrictions on visitor travel and activities, tolerance for impacts on marine, terrestrial, or submerged resources would remain moderate. Through random contacts, most visitors would receive a moderate level of education regarding resource protection. Opportunities to educate private boaters on resource protection issues would remain limited.

Boater education programs would urge caution in anchoring around coral reefs and sea grass beds to avoid damaging these resources. However, the level of patrols for monitoring and providing guidance for visitor activities would continue to be low, and the potential for impacts on resources from anchoring would remain high. Surveys and monitoring of resources would continue to be ad hoc, as time and funding permit. With no approved research plan in place, the level of research accomplished would remain low to moderate.

Limited monitoring and research would continue to be conducted primarily for water analysis related to wastewater facilities and some fisheries and cultural resources. However, this monitoring would not be accomplished within a well-integrated framework of goals.

COMMERCIAL SERVICES

All commercial services would continue to be authorized by commercial use authorizations. This would include transportation to and within the park, fishing charters, snorkeling, scuba diving, photography, and wildlife viewing. Current commercial use authorizations have conditions included in the permit to accommodate carrying capacities in the park, protect resources, and enhance visitor experience. These conditions would continue at a minimum and be increased if warranted. One condition provides commercial operators with interpretive materials they can use on a voluntary basis with their clients. Another limits the number of passengers brought to the fort by the larger vessels to 100 per vessel. Commercial use authorizations would continue to be issued by the concessions staff at Everglades National Park and monitored by the staff at Dry Tortugas. Given the small staff at the park and their resource protection and visitor safety priorities, monitoring these authorizations would receive less than ideal attention.

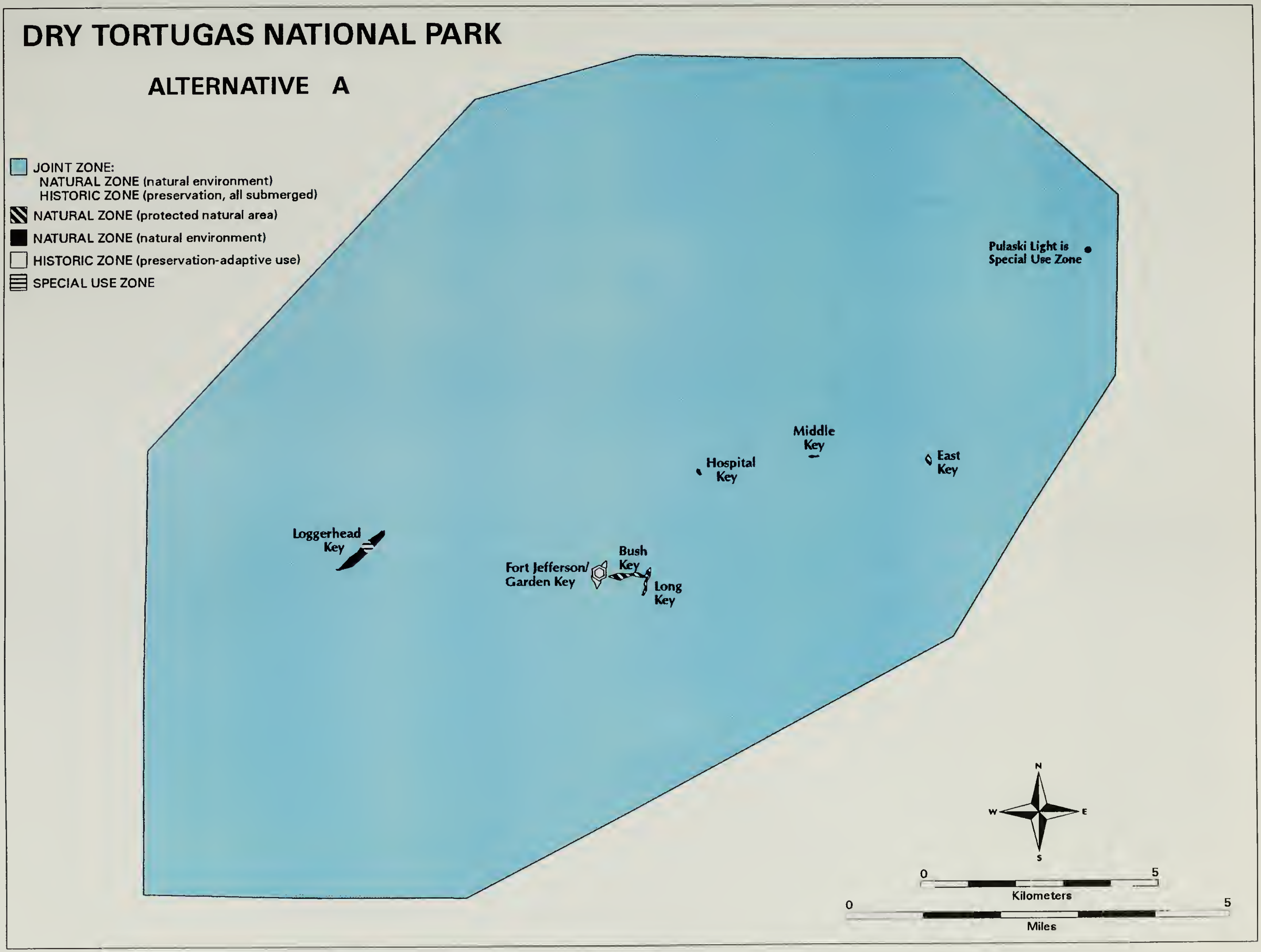
PARK OPERATIONS AND FACILITIES

NPS operations throughout the park would be unchanged (see the "Affected Environment" section). The main concerns would continue to be that the park is understaffed and unable to adequately protect resources because of increasing visitation. Some facilities are already exceeding their capacity during peak visitation periods. Most management operations would be for protecting resources, preventing or minimizing impacts from visitor use, and restoring disturbed areas. In the historic preservation/adaptive use zone, operations would continue to focus on providing a quality visitor experience.

Because activities by visitors with access to intrapark transportation would continue to be largely unrestricted, patrols to monitor prohibited activities such as collection of

DRY TORTUGAS NATIONAL PARK

ALTERNATIVE A



🟦 JOINT ZONE:
NATURAL ZONE (natural environment)
HISTORIC ZONE (preservation, all submerged)
▨ NATURAL ZONE (protected natural area)
■ NATURAL ZONE (natural environment)
☐ HISTORIC ZONE (preservation-adaptive use)
▤ SPECIAL USE ZONE
Pulaski Light is Special Use Zone
Middle Key
Hospital Key
East Key
Loggerhead Key
Bush Key
Fort Jefferson/ Garden Key
Long Key
N
W
E
S
0
5
Kilometers
0
5
Miles

corals and artifacts from shipwrecks would continue to be necessary and labor intensive. Regular patrols to ensure visitor safety and offering assistance would continue.

A high level of NPS commitment would continue to be needed to educate and inform visitors about the park's history, its resources, and the protection of those resources. However, staffing likely would remain too low to accomplish these tasks adequately. With few facilities to maintain, such as mooring buoys, the NPS maintenance effort would remain at a low level and focus primarily on the dock, campground, and fort.

ALTERNATIVE B

ALTERNATIVE B =				
The servicewide mandates and policies	+	The parkwide management actions	+	The actions described below that support the concept for this particular alternative

OVERALL CONCEPT

The concept of alternative B provides for greater protection of natural and cultural resources than under alternative A (see Alternative B map). The types and levels of visitor use would be managed to protect resources and the quality of the visitor experiences. The total numbers of visitors transported to the park by commercial operators would be consistent with the aggregated carrying capacity targets of individual visitor destinations (see tables1-3 and appendix D). Where critical resource degradation was observed, the park staff would direct intensive protection and/or remediation measures to abate impacts. Visitors would be free to travel and experience a variety of recreational opportunities throughout much of the park provided that appropriate conditions were maintained.

VISITOR EXPERIENCE

Access to the park would be provided by commercial aircraft and by large and small vessels (holding commercial use authorizations) and private boats. Visitors would be able to travel freely throughout the park; however, visitors who arrive via commercial tours would have very limited opportunities to travel to sites other than Garden Key. The entire park, except in special protection zone areas, would be open to private boaters to dive, snorkel, and do recreational fishing.

The number of visitors arriving at the park on large commercial vessels would be limited. The total number of visitors at one time on Garden Key or any other destination within the park has been tentatively determined by the desired resource condition and visitor experience for each site (see tables 1-3 and appendix D).

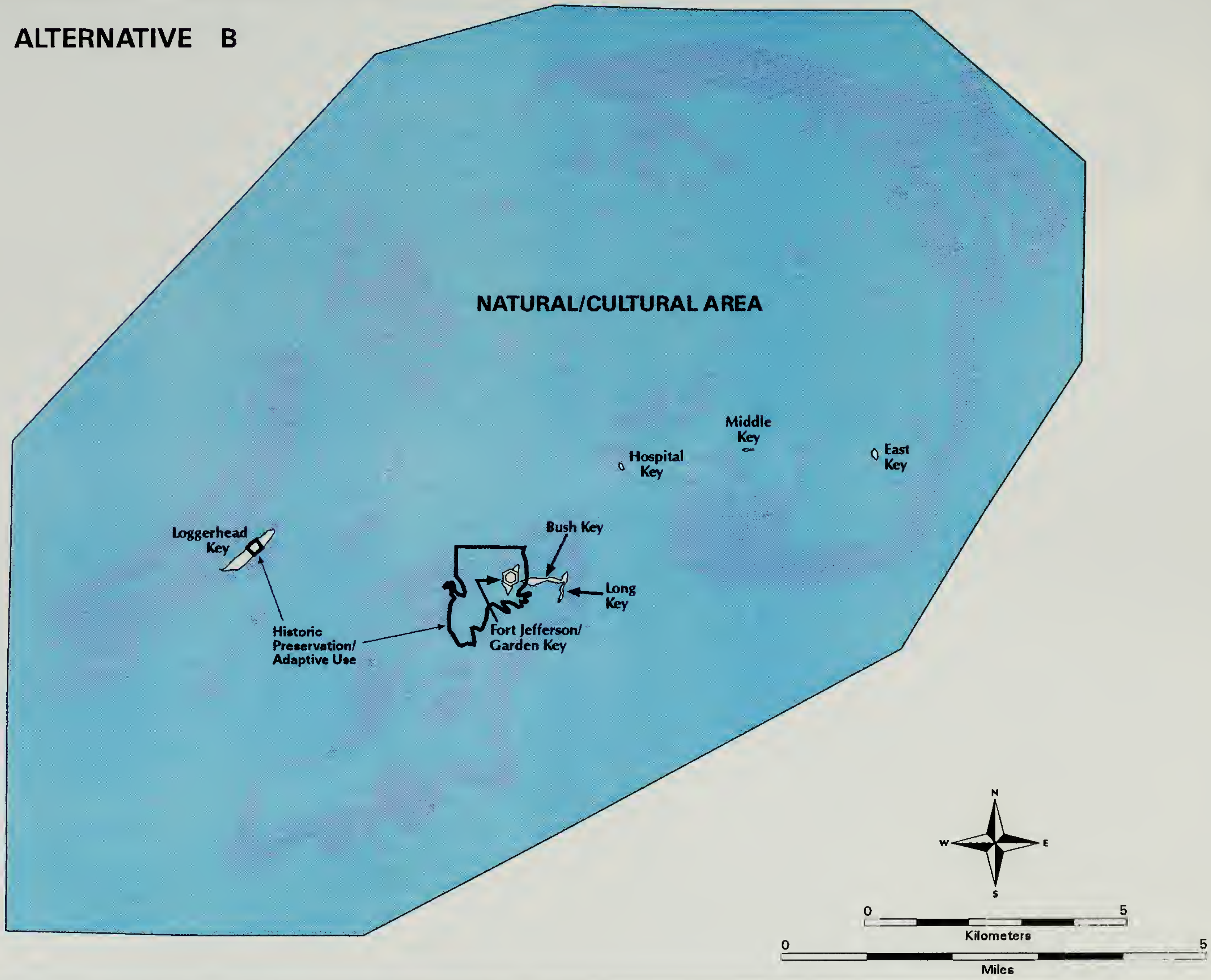
Anchoring by private boaters and commercial carriers would be allowed. Although anchoring would be allowed, mooring buoys would be used to direct visitors to selected sites. However, overnight anchoring would be restricted to an area within the historic preservation/adaptive use zone around Garden Key.

Various and mostly unstructured self-guided or self-initiated experiences (e.g., snorkeling, diving, sailing) would be available to private boaters and could offer a high level of adventure and challenge. Visitors with a private boat or a guide hired offsite would have access to the offshore coral reefs, shipwrecks, and keys other than Garden Key. Because guided tours would be very limited, tour visitors would enjoy those activities available at Garden Key, such as the fort tour, snorkeling, walking the moat, and swimming, which would require fewer skills and offer less adventure. However, these visitors could experience the sense of remoteness and peace that the location of Garden Key in the Straits of Florida provides even though many visitors would be present at one time. True quiet and solitude would likely be experienced only by the private boaters. Their opportunities for such peace would be high.

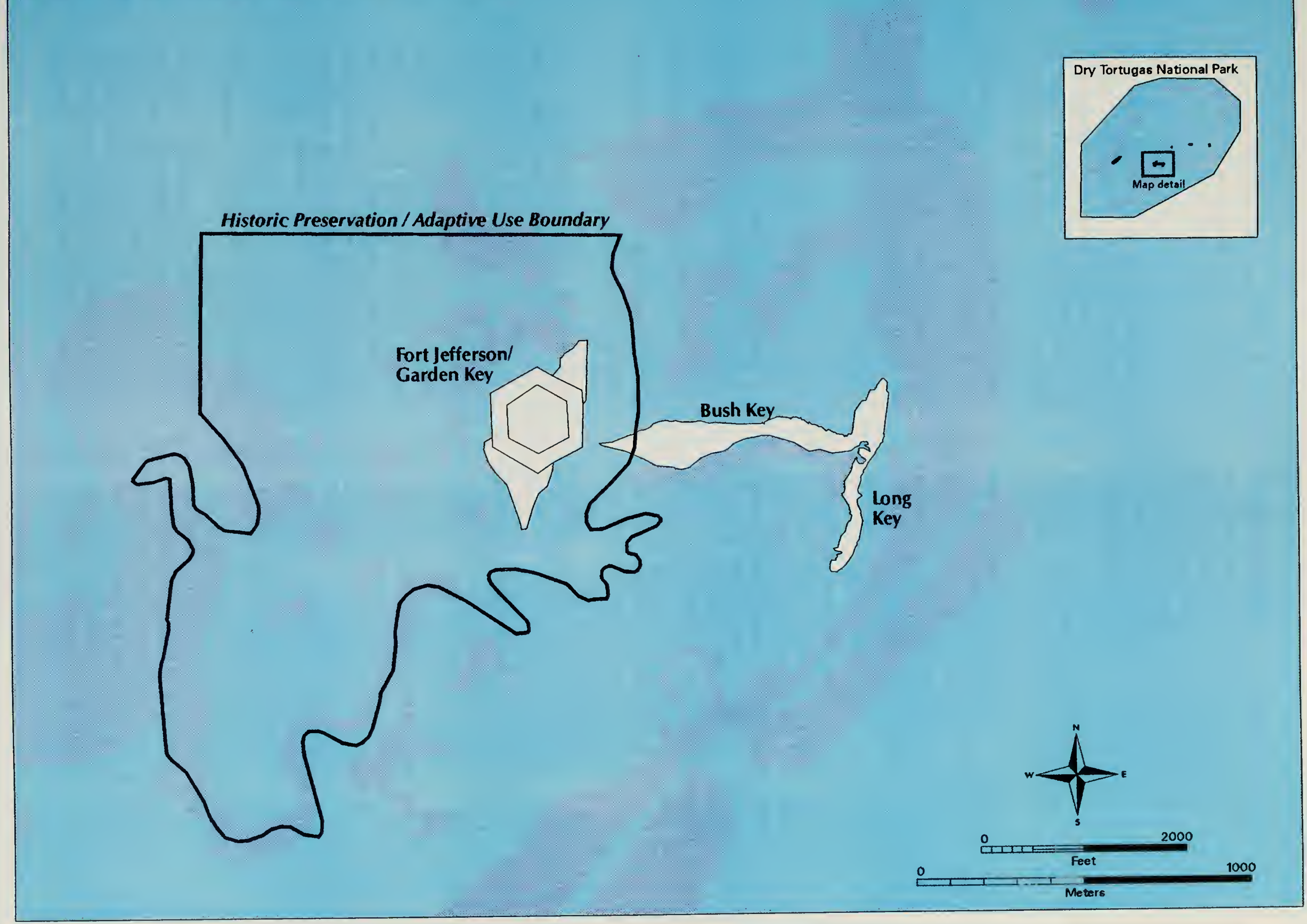
The map after the Alternative D map shows in more detail the historic preservation/ adaptive use zone boundary, which is for all alternatives.

DRY TORTUGAS NATIONAL PARK

ALTERNATIVE B



DRY TORTUGAS NATIONAL PARK



In this alternative, visitors would be moderately to highly likely to encounter staff or other visitors, especially on Garden Key.

Opportunities for visitors arriving by private boats to learn would be moderate due to limited interpretive media and tours. Visitors arriving by commercial transportation would have an enhanced opportunity for education/interpretation/information as part of their tour package at Key West, in transit, at the fort, and at any other tour destination.

Recreational fishing with the required state license would remain unrestricted under this alternative.

RESOURCE PROTECTION

Although anchoring would be permitted, visitors would be directed to anchor in areas where there would be little risk for damaging the underwater resources.

In this alternative there would be low tolerance for impacts from recreational use.

Systematic, scheduled monitoring would document changes in species and communities to provide direction for resource management and research. Monitoring and research would be conducted on impacts on resources from visitor use, such as the affect on coral reefs from anchoring or concentrating visitor use with mooring buoys. Other monitoring actions would include determining population and biodiversity of marine and terrestrial species.

Submerged Cultural Resource Strategy

The NPS Submerged Cultural Resources Unit has undertaken a comprehensive archeological survey and inventory of submerged sites within the park. The project began in 1992 with the compilation and assessment of natural and cultural resource data that provided the foundation for development of the survey research design. GIS (geographic information system) computer applications were incorporated into the survey methodology. The project is a model for a wide-area survey of submerged NPS areas.

Using remote sensing magnetometer methods, surveys have been completed for more than 95% of the park's waters at depths of less than 30 feet. The technique was designed to detect ferrous metal objects, indicating potential site locations. Survey coverage of the entire park waters at all depths will eventually be completed.

A comprehensive and multidisciplinary monitoring program would be implemented to provide both annual site assessments and long-term detailed assessments for selected locations. As needed, more frequent assessments would evaluate reports of diver impacts, conditions following storms, etc. Site research would be conducted in accordance with approved research designs that support park management objectives. Archeological research and investigations would meet applicable NPS standards and would have minimal site impacts.

The park would also implement measures to enhance site protection. Diving at shipwrecks would be permitted only in approved areas by means of mooring buoys and other methods. Visitors would be directed away from sensitive site locations, and remote sensing surveillance systems would assist park patrol efforts to protect significant sites.

COMMERCIAL SERVICES

Commercial use authorizations would authorize all commercial operations for activities determined to be appropriate for Dry Tortugas National Park. All commercial use authorizations would include, but not be limited to, conditions for operations, carrying capacity, resource protection, environmental awareness, interpretation, and visitor safety. Operators of large commercial vessels would be limited to 100 passengers per day. The conditions for interpretation would include the provision of interpretive materials as in alternative A and personal service training from NPS staff. Training would also be available from NPS staff for resource protection and visitor safety. Participation in this training would not be required but strongly encouraged. Commercial use authorizations would be issued by the concessions staff at Everglades National Park and monitored by the staff at Dry Tortugas National Park. The monitoring of these authorizations would be a higher priority than it is currently, and therefore staff would be dedicated to this activity.

Although not required, commercial vessel operators would be encouraged to provide intrapark transportation and tours to sites throughout the park, subject to the carrying capacity limits identified for the natural/ cultural zone. Commercial operators, as well as private boaters, would be required to stay out of closed areas and would be directed to areas thought to be less sensitive by the National Park Service. They would not be assigned any facilities in the park and would be subject to regulations and policies such as use of the NPS dock at Garden Key.

PARK OPERATIONS AND FACILITIES

NPS operations throughout the park would be unchanged (see the "Affected Environment" section). The main concerns include that the park is understaffed and unable to adequately protect resources because of increasing visitation and some facilities are exceeding their capacity during peak visitation periods. Most management operations would be for protecting resources, preventing or minimizing impacts from visitor use, and restoring disturbed areas. In the historic preservation/ adaptive use zone, operations would continue to focus on providing a quality visitor experience.

Because visitors would be permitted to travel freely throughout the park with few restrictions on activities, a high level of patrols would be needed to monitor visitor use especially by private boaters. A high level of NPS commitment would continue to be needed to educate and inform visitors about the park's history, its resources, and the protection of those resources. With few facilities to maintain, the NPS maintenance efforts would remain at a low level and focus primarily on the dock, campground, and fort.

PARK ENTRANCE FEE

A park entrance fee would be instituted to help support the additional costs incurred for managing carrying capacities, visitor safety and enjoyment, resource protection activities, and monitoring. (The authority to charge fees may end; however, the park would charge an entrance fee as long as this authority exists.)

ALTERNATIVE C: PROPOSED ACTION

ALTERNATIVE C =				
The servicewide mandates and policies	+	The parkwide management actions	+	The actions described below that support the concept for this particular alternative

OVERALL CONCEPT

The intent of this alternative is to afford a high level of protection to significant park resources through the selective application of the research natural area zone, instituting a permit system for private boaters, and using commercial services to direct and structure visitor use (see Alternative C map). A wide range of recreational and educational opportunities would be available to visitors provided that appropriate resource conditions were maintained. Visitor experience would be enhanced due to expanded access throughout the park and higher quality resources to enjoy. The goal for the commercial service operations would be to be self-contained, thus reducing the strain on the limited park facilities. The types and levels of visitor use would be managed to protect resources and the quality of the visitor experiences. The total numbers of visitors transported to the park by commercial operators would be consistent with the aggregated carrying capacity targets of individual visitor destinations (see tables1-3 and appendix D).

The research natural area zone in this alternative would be compatible with the ecological reserve that is proposed by the National Oceanic and Atmospheric Administration for the Florida Keys National Marine Sanctuary, having the same goals and subsequent constraints on fishing.

See appendix F for the rationale for selecting this alternative as the National Park Service's proposed action.

VISITOR EXPERIENCE

Under this alternative, commercial operators would continue to provide transportation to the park, but the role of the commercial operators would be significantly expanded for day use activities. This expanded role would be to provide intrapark transportation and guide services. A limited number of overnight/multiday tours would be conducted by operators holding a commercial use authorization.

The distribution of visitors to key destinations throughout the park would be managed largely through these commercial tours. Visitors would be required to use commercial tours or private boats (by permit) to visit and enjoy attractions in the research natural area zone. For recreational activities inside the park, including the research natural area, all private boaters would be required to obtain a permit, pay a park entrance fee at Garden Key, learn about the protection of park features, and adhere to established maximum numbers of visitors to individual sites and attractions (see tables 1–3 and appendix D). The tour providers and private boaters would be required to moor at buoys in the research natural area zone. Neither anchors nor recreational fishing would be allowed in the research natural area zone, but these activities would be allowed in the remaining zones. All private and commercial vessels must overnight in the historic preservation/ adaptive use zone around Garden Key (see detail map of this zone in the chapter on alternative B). A reservation system might be instituted for the campground in the future.

Although the experiences for tour visitors in this alternative would be highly structured, the opportunities would be more diverse than in the previous alternatives. In the previous alternatives, visitors with a private boat or a guide hired offsite would have access to the offshore coral reefs, shipwrecks, and keys other than Garden Key. Under this alternative, all visitors to the park would have the opportunity to visit remote park attractions. Activities would include snorkeling and diving at selected coral reefs and shipwrecks, swimming, and bird watching, in addition to the activities available at Garden Key.

Opportunities for challenge and adventure on tours throughout the park would be high. Likely encounters with other visitors who are not part of one's individual tour would be low, especially in the research natural area. The presence of commercial staff, especially in the research natural area, would be high.

It is anticipated that this would be the first time many of these visitors would have the opportunity to engage in activities in a near-pristine environment like the Dry Tortugas. All of these visitors would encounter commercial staff, but the potential to encounter NPS staff or other groups would be low to moderate in the entire park except in the historic preservation /adaptive use zone near the fort. Although individuals would be in small groups, the opportunity level for the group to experience quiet and solitude would be high.

Opportunities for all visitors to learn more about the Dry Tortugas and its environs would be very high. Private boaters would have contact with NPS staff through the permit process, thus increasing their opportunities to gain knowledge and information about the park. Visitors arriving on the commercial ferries for day use, or with commercial guides for overnight/multiday use, would have a high level of opportunity to gain knowledge, information, and interpretation from trained commercial tour staff at the docking facility in Key West, en route to the park, and on tours. All visitors would have an orientation to the purpose and significance of the research natural area zone from NPS or commercial tour staff. All visitors would have access to information and interpretation at Fort Jefferson through media such as wayside exhibits, bulletin boards, visitor center exhibits, videos, and publications.

The zoning and visitor use management schemes in this alternative would strive to create a high-quality experience for visitors through the sustained integrity of the natural and cultural resources, the lack of intrusions and alterations to the natural landscape and seascape, the even dispersal of visitors, the interpretation methods used, and the enhanced knowledge gained from research. Visitors would also receive the benefit of new information coming to light as a result of research activities of park scientists and investigators.

RESOURCE PROTECTION

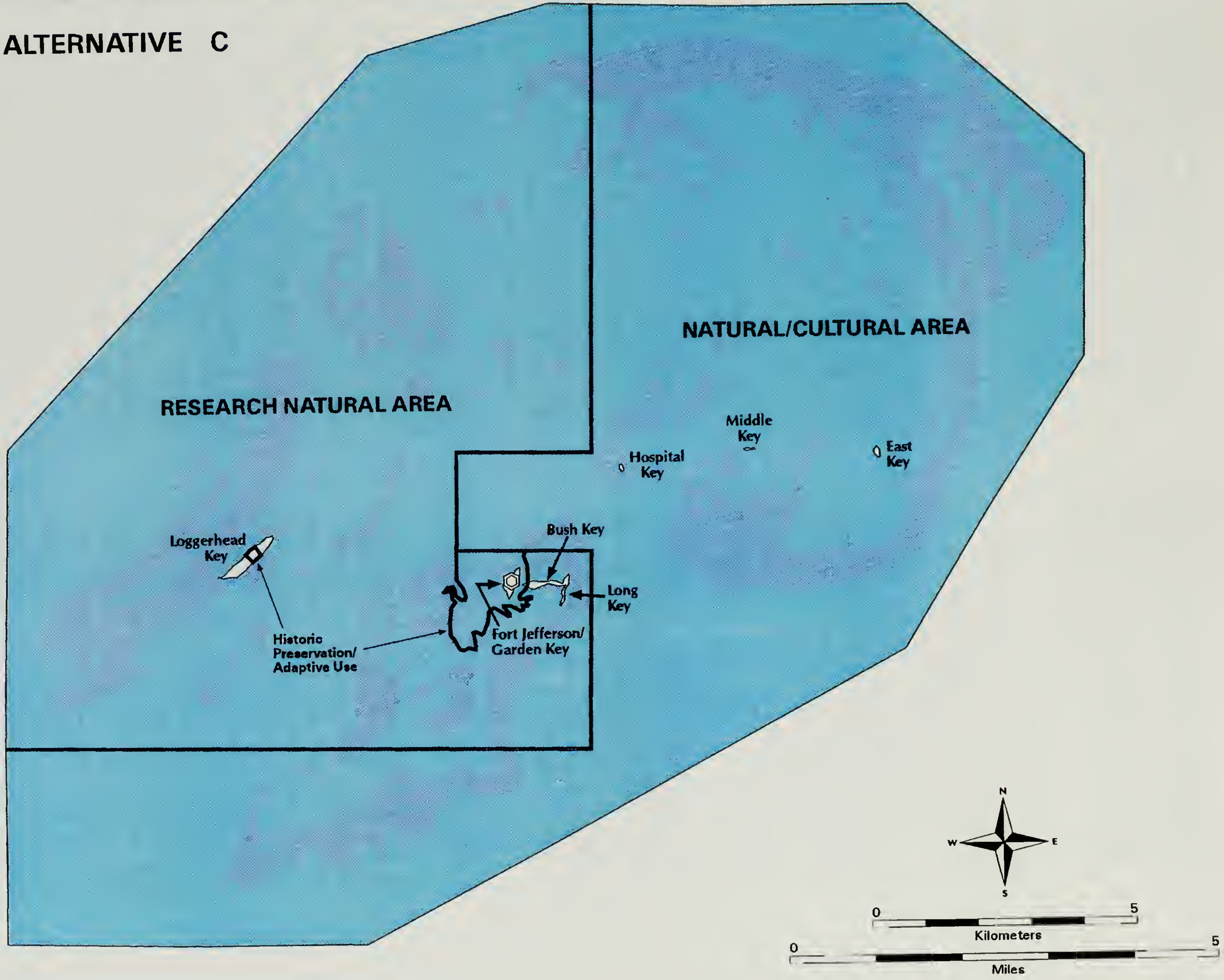
There would be very low tolerance for impacts on terrestrial, marine, or submerged cultural resources due to visitor use in the research natural area zone portion of the park. There would be a low tolerance for impacts from visitor use on these resources in the natural/cultural zone. There would be low to moderate tolerance for impacts on these resources from visitor use in the historic preservation/adaptive use zone.

To protect marine resources, anchoring would be permitted only in the natural/cultural and historic preservation/adaptive use zones, and the use of mooring buoys would be required in research natural area zones to direct visitors to selected sites.

An aggressive visitor education program would focus on park resources and history and resource protection. Education and interpretation would be incorporated into tour activities. The private boat permit

DRY TORTUGAS NATIONAL PARK

ALTERNATIVE C



system would include a high level of education in resource protection. All visitors would receive education on the purpose and significance of the research natural area zone and how the concept is being used internationally.

Commercial tour users and private boaters in the research natural area would be required to use mooring buoys. Private boat operators would be directed to less sensitive areas when possible, and patrols would monitor for inappropriate activities. Commercial tours in the other zones would be managed similarly to management in the research natural area zone.

No manipulation of resources by the Park Service, other agencies, researchers authorized by the park, or visitors would be allowed in the research natural area zone except for restoration. Minor manipulation of resources in the other zones would be allowed, but only for visitor safety or resource protection reasons. Consequently, the potential for biodiversity and increased populations of marine life would be high in the research natural area zone and moderate in the remainder of the park.

All natural and cultural resources in the park would be surveyed, and a regular monitoring program would be implemented, regardless of zone. A high level of nonmanipulative research would occur in the research natural area, and a moderate to high level would occur in the remainder of the park.

Systematic, scheduled monitoring would document changes in species and communities to provide direction for resource management and research. Monitoring and research would be conducted on impacts on resources from visitor use, such as the affect on coral reefs from anchoring or concentrating visitor use with mooring buoys. Other monitoring actions would include determining population and biodiversity of marine and terrestrial species.

The National Park Service would work with the National Oceanic and Atmospheric Administration and the state of Florida to continue to study the importance of the Tortugas area to the fisheries of the region and the hemisphere.

Submerged Cultural Resource Strategy

The NPS Submerged Cultural Resources Unit has undertaken a comprehensive archeological survey and inventory of submerged sites within the park. The project began in 1992 with the compilation and assessment of natural and cultural resource data that provided the foundation for development of the survey research design. The project is a model for a widearea survey of submerged NPS areas.

Using remote sensing magnetometer methods, surveys have been completed for more than 95% of the park's waters at depths of less than 30 feet. The technique was designed to detect ferrous metal objects, indicating potential site locations. Survey coverage of the entire park waters at all depths will eventually be completed (see the "Affected Environment" section for survey results).

A comprehensive and multidisciplinary monitoring program would be implemented to provide both random sample annual site assessments and long-term detailed assessments for selected locations. As needed, more frequent assessments would evaluate reports of diver impacts, conditions following storms, etc. Site research would be conducted in accordance with approved research designs that support park management objectives. Archeological research and investigations would meet applicable NPS standards and would have minimal site impacts.

The park would also implement measures to enhance site protection. Diving would be permitted only in approved areas by means of mooring buoys or anchoring where permitted. Visitors would be directed away from sensitive site locations, and remote sensing surveillance systems would assist park patrol efforts to protect significant sites.

COMMERCIAL SERVICES

Access to the park for single-day visitors would be provided through two concession contracts. One contract would be for a single seaplane operator and the other for a single, large vessel/ferry operator. The seaplane operation would be authorized to carry a total of 30–50 visitors per day. The number of trips would depend on the capacity of the planes being used. Beach tie points would be assigned to the seaplane concessioner, and a section of the beach near the dock would be dedicated to the operation. The ferry concessioner would be authorized to make one trip per day and carry 150–200 visitors. Actual capacity numbers would be managed and balanced to achieve total per day capacity targets for the park.

The ferry concessioner would also be required to provide day use intrapark transportation and tours using smaller boats. Mandatory interpretive and resource protection training and auditing by NPS staff would be required for all concessioner tour staff. A reservation system for the tours would be an integral part of the operations plan for the concessioner. Tours in the natural/cultural zone would be limited by established site carrying capacities. Tours in the research natural area zone would be managed the same as all other activities in the zone, with site carrying capacities enforced and the use of mooring buoys required.

Because most visitor use would be generated by commercial tours, the concessioner would be allocated 60%–80% of the available sites or a separate mooring buoy system would be established. Authorized tours would include fort tours, snorkeling, scuba diving, kayaking, and scenic/wildlife tours. Fort tours would be coordinated with NPS staff. The concessioners would be authorized to rent or provide necessary goods and equipment such as masks, fins, snorkels, diving tanks, compressed air, and kayaks. The concessioners would also be authorized to provide food and beverage service (lunch) similar to what occurs now. The ferry and air taxi concessioners would have exclusive rights to any day use commercial tours that begin or end within park boundaries.

The goal for the ferry/transportation concession contract would be for the operation to be self-contained; that is, all supplies and equipment, including the small boats used for intrapark transportation and tours, would be brought to and from the park daily via the large, primary vessel.

Also inherent in a self-contained operation is the need to provide for all the needs of the visitors while in the park and thus take the strain off the limited facilities at the park. Sanitary facilities and fresh water are two of the most limited resources in the park. A self-contained operation would make these facilities available to their passengers during their entire visit. Wastes generated would be packed out of the park by the concessioner. Similarly, passengers need a place to eat lunch without straining the limited park picnic facilities and to get out of the weather without straining space in the fort visitor center.

To make the self-contained concept work to its fullest potential, the primary vessel must be accessible during the entire visit to the park. This requires space at the dock at Garden Key. However, the permit system for private boaters would require all those vessels to come in to the dock at Garden Key. This would strain the dock facility even without the concessioner vessel. An extension of the existing dock for the concession vessel or alternative docking facilities would be required. The ferry concession contract would call for the concessioner to pay for the construction of the new dock. Although the new dock would belong to the National Park Service, the concessioner would bear the costs to build the dock. The concessioner would then be assigned use of the dock for a term sufficient to recover the investment.

Other appropriate uses in the park might be authorized by commercial use authorizations (CUAs). These other guides would provide overnight/ multiday commercial tours. The number of operators would not exceed 30 or the capacity of the resources to accommodate the use, which would be determined by monitoring. No facilities would be dedicated to these operators.

Sailing excursions would be authorized and limited to 20 to 25 visitors per trip. CUA permits for guided fishing charters in six-pack boats for fishing in the natural/cultural zone only would be subject to specific regulations to protect fisheries resources as warranted. No CUA permits would be issued for guided fishing charter boats in excess of six passengers per vessel. Likewise, CUA permits would be issued to conduct wildlife tours, including bird-watching, provided the tours begin and end outside of the park boundary. CUA permit holders would be subject to established carrying capacity restrictions for the use of sites and areas within the park (see tables 1-3 and appendix D).

The cooperating association would sell a limited selection of health and safety-related items, and limited educational and interpretive merchandise related to the interpretive themes of the park. The concessioner would not be authorized to sell any of these items on the boat whether in the park or en route.

PARK OPERATIONS AND FACILITIES

To afford the high level of resource protection proposed in this alternative, a moderate to high amount of NPS patrolling and monitoring would occur in the natural/ cultural zone. A moderate to high level of patrolling and monitoring of visitor use would occur in the research natural area zone due to the permit and commercial tour operations proposed. However, private boats would continue to be present in the research natural area zone. To conduct/manage research and survey/ monitor resources, NPS staff would expend a moderate to high amount of effort.

Resource protection and interpretive training of all commercial operators would be required, calling for a moderate to high amount of effort by NPS staff. All private boaters obtaining permits would receive similar training, which would require a moderate to high amount of effort by NPS staff. NPS staff would conduct most tours of the fort, although trained commercial staff would conduct some. Visitor information would be available at a new contact station in Key West, requiring NPS staff commitment.

NPS staff would maintain most of the facilities in the park, although facilities assigned to concessioners would have facility maintenance included in their contracts.

A reservation system might be established for the campground on Garden Key to ensure that visitor expectations were met.

PARK ENTRANCE FEE

A park entrance fee would be instituted to help support the additional costs incurred for managing carrying capacities, visitor safety and enjoyment, resource protection activities, and monitoring. (The authority to charge fees may end; however, the park would charge an entrance fee as long as this authority exists.)

ALTERNATIVE D

ALTERNATIVE D =				
The servicewide mandates and policies	+	The parkwide management actions	+	The actions described below that support the concept for this particular alternative

Alternative D is the same as alternative C except that (1) the research natural area zone boundaries would be slightly different (see Alternative D map) and align with the Florida Keys National Marine Sanctuary's preferred alternative for establishing ecological reserves in the Tortugas area, and (2) private boaters would not be allowed to anchor or tie up to a mooring buoy for diving, snorkeling, etc. in the research natural area (however, private boaters would be allowed to transit through the research natural area).

The research natural area zone in this alternative would be compatible with the ecological reserve that is proposed by the National Oceanic and Atmospheric Administration for the Florida Keys National Marine Sanctuary, having the same goals and subsequent constraints on fishing.

OVERALL CONCEPT

The intent of this alternative is to afford a high level of protection to significant park resources through the selective application of the research natural area zone, instituting a permit system, and using commercial services to direct and structure visitor use. The types and levels of visitor use would be managed to protect resources and the quality of the visitor experiences. The total numbers of visitors transported to the park by commercial operators would be consistent with the aggregated carrying capacity targets of individual visitor destinations (see tables1-3 and appendix D). Outside the research natural area zone, a wide range of recreational opportunities would be available to visitors provided that appropriate resource conditions were maintained. Visitor experience would be enhanced due to expanded opportunities throughout the park and higher quality resources to enjoy. Commercial service operators would also provide visitor comfort facilities on board, reducing the strain on the limited park facilities.

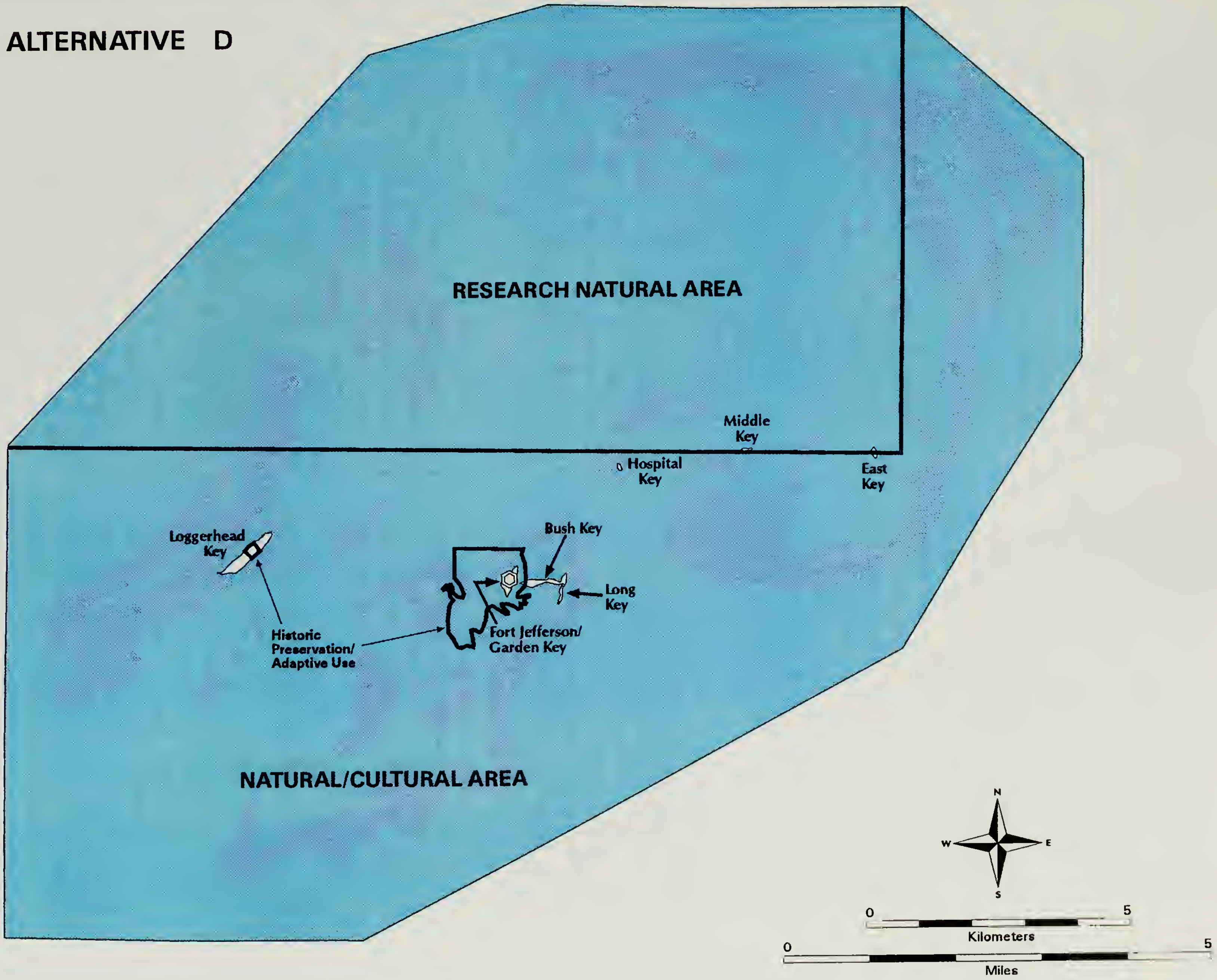
VISITOR EXPERIENCE

Under this alternative, commercial operators would continue to provide transportation to the park, but the role of the commercial operators would be significantly expanded for day use activities. This expanded role would be to provide intrapark transportation and guide services. Overnight/multiday commercial tours would be conducted exclusively by CUA operators who begin and end tours in Key West or other offsite locations.

The distribution of visitors to key destinations throughout the park would be managed largely through these commercial tours. Visitors would be required to use commercial tours to visit and enjoy attractions in the research natural area zone. The tour providers would be required to moor at buoys in the research natural area zone. Neither anchors nor recreational fishing would be allowed in the research natural area zone, but these activities would be allowed in the remaining zones. For recreational activities inside the park but outside the research natural area, private boaters would be required to obtain a permit and pay an entrance fee at Garden Key, learn about the protection of park features,

DRY TORTUGAS NATIONAL PARK

ALTERNATIVE D



and adhere to established maximum numbers of visitors to individual sites and attractions (see tables 1–3 and appendix D). All private and commercial vessels must overnight in the historic preservation/ adaptive use zone around Garden Key (see detail map of this zone in the chapter on alternative B). A reservation system might be instituted for the campground in the future.

Although the experiences for tour visitors in this alternative would be highly structured, the opportunities would be more diverse than in the previous alternatives. In the previous alternatives, visitors with a private boat or a guide hired offsite would have access to the offshore coral reefs, shipwrecks, and keys other than Garden Key. Under this alternative, all visitors to the park would have the opportunity to visit remote park attractions. Activities would include snorkeling and diving at selected coral reefs and shipwrecks, swimming, and bird watching, in addition to the activities available at Garden Key. Recreational fishing would not be permitted in the research natural area zone.

Opportunities for challenge and adventure on the tours throughout the park would be high. Likely encounters with other visitors not a part of ones individual tour would be low, and nonexistent in the research natural area. The presence of commercial staff, especially in the research natural area, would be high.

It is anticipated that this would be the first time many visitors would have the opportunity to engage in activities in a near-pristine environment like the Dry Tortugas. All of these visitors would encounter commercial staff, but the potential to encounter NPS staff or other groups would be low to moderate in the entire park except in the historic preservation /adaptive use zone near the fort. Although individuals would be in small groups, the opportunity level for the group to experience quiet and solitude would be high.

Opportunities for all visitors to learn more about the Dry Tortugas and its environs would be very high. Private boaters would have contact with NPS staff, thus increasing their opportunities to gain knowledge and information about the park through the permit process. Visitors arriving on the commercial ferries for day use, or commercial guides for overnight/multiday use, would have a high level of opportunity to gain knowledge, information, and interpretation from trained commercial tour staff at the docking facility in Key West, en route to the park, and on tours. All visitors would have an orientation to the purpose and significance of the research natural area zone from NPS or commercial tour staff. All visitors would have access to information and interpretation at Fort Jefferson.

The potential for all visitors to have a high-quality experience would be great due to the integrity of the natural and cultural resources, the lack of intrusions and alterations to the natural landscape and seascape, the even dispersal of visitors, the low-key interpretation methods, and enhanced knowledge gained from research. The zoning and visitor use management schemes in this alternative create these conditions. Visitors would also receive the benefit of new information coming to light as a result of research activities of park scientists and investigators.

RESOURCE PROTECTION

There would be very low tolerance for impacts on terrestrial, marine, or submerged cultural resources due to visitor use in the research natural area zone portions of the park. There would be a low tolerance for impacts from visitor use on these resources in the natural/cultural zone. There would be low to moderate tolerance for impacts on these resources from visitor use in the historic preservation/adaptive use zone.

An aggressive visitor education program would focus on park resources and history and resource protection. Education and interpretation would be incorporated into tour activities. Through the process of getting a permit to enter the natural/cultural zone, private boaters would learn about the park features and resource protection and be informed about the established maximum numbers of visitors to individual sites and attractions. All visitors would receive education on the purpose and significance of the research natural area zone and how the concept is being used internationally. To protect marine resources, anchoring would be permitted only in the natural/cultural and historic preservation/ adaptive use zones, and the use of mooring buoys would be required in research natural area zones.

Commercial tour use in the research natural area would also be directed, and operators would be required to use mooring buoys. In the other zones in the park, private boat operators would be directed to less sensitive areas when possible, and patrols would monitor for inappropriate activities. Commercial tours in the other zones would be managed similarly to management in the research natural area zone.

No manipulation of resources by the Park Service, other agencies, researchers, or visitors would be allowed in the research natural area zone except for restoration. Minor manipulation of resources in the other zones would be allowed, but only for visitor safety and resource protection reasons.

All natural and cultural resources in the park would be surveyed, and a regular monitoring program would be implemented, regardless of zone. A high level of nonmanipulative research would occur in the research natural area, and a moderate to high level would occur in the remainder of the park.

Systematic, scheduled monitoring would document changes in species and communities to provide direction for resource management and research. Monitoring and research would be conducted on impacts on resources from visitor use, such as the affect on coral reefs from anchoring or concentrating visitor use with mooring buoys. Other monitoring actions would include determining population and biodiversity of marine and terrestrial species.

Submerged Cultural Resource Strategy

The NPS Submerged Cultural Resources Unit has undertaken a comprehensive archeological survey and inventory of submerged sites within the park. The project began in 1992 with the compilation and assessment of natural and cultural resource data that provided the foundation for development of the survey research design. GIS (geographic information system) computer applications were incorporated into the survey methodology. The project is a model for a widearea survey of submerged NPS areas.

Using remote sensing magnetometer methods, surveys have been completed for more than 95% of the park's waters at depths of less than 30 feet. The technique was designed to detect ferrous metal objects, indicating potential site locations. Survey coverage of the entire park waters at all depths will eventually be completed (see the "Affected Environment" section for survey results).

A comprehensive and multidisciplinary monitoring program would be implemented to provide both random sample annual site assessments and long-term detailed assessments for selected locations. As needed, more frequent assessments would evaluate reports of diver impacts, conditions following storms, etc. Site research would be conducted in accordance with approved research designs that support park management objectives. Archeological research and investigations would meet applicable NPS standards and would have minimal site impacts. Information would continue to be compiled in the GIS database.

The park would also implement measures to enhance site protection. Diving would be permitted only in approved areas by means of mooring buoys and other methods. Visitors would be directed away from sensitive site locations, and remote sensing surveillance systems would assist park patrol efforts to protect significant sites.

The National Park Service would work with the National Oceanic and Atmospheric Administration and the state of Florida to continue to study the importance of the Tortugas area to the fisheries of the region and the hemisphere.

COMMERCIAL SERVICES

Access to the park for single-day visitors would be provided through two concession contracts. One contract would be for a single seaplane operator and the other for a single, large vessel/ferry operator. The seaplane operation would be authorized to carry a total of 30–50 visitors per day. The number of trips would depend on the capacity of the planes being used. Beach tie points would be assigned to the seaplane concessioner, and a section of the beach near the dock would be dedicated to the operation. The ferry concessioner would be authorized to make one trip per day and carry 150–200 visitors. Actual capacity numbers would be managed and balanced to achieve total per day capacity targets for the park.

The ferry concessioner would also be required to provide day use intrapark transportation and tours using smaller boats. Mandatory interpretive and resource protection training and auditing by NPS staff would be required for all concession tour staff. A reservation system for the tours would be an integral part of the operations plan for the concessioner. Tours in the natural/cultural zone would only be limited by established site carrying capacities. Tours in the research natural area zone would be the only activities in the zone, with site carrying capacities enforced and the use of mooring buoys required.

Because visitor use would be generated by commercial tours, the concessioner would be allocated 100% of the available sites. Authorized tours would include fort tours, snorkeling, scuba diving, kayaking, and scenic/wildlife tours. Fort tours would be coordinated with NPS staff. The concessioners would be authorized to rent or provide necessary goods and equipment such as masks, fins, snorkels, diving tanks, compressed air, and kayaks. The concessioners would also be authorized to provide food and beverage service (lunch), similar to what occurs now. The ferry and air taxi concessioners would have exclusive right to any day use commercial tours that begin and end in the park.

The goal for the ferry/transportation concession contract would be for the operation to be self-contained; that is, all supplies and equipment, including the small boats used for intrapark transportation and tours, would be brought to and from the park daily via the large, primary vessel.

Also inherent in a self-contained operation is the need to provide for all the needs of the clients while in the park and not straining the limited facilities at the park. Sanitary facilities and fresh water are two of the most limited resources in the park. A self-contained operation would make these facilities available to their passengers during their entire visit. Wastes generated would be packed out of the park by the concessioner. Similarly, passengers need a place to eat lunch without straining the limited park picnic facilities and to get out of the weather without straining space in the fort visitor center.

To make the self-contained concept work to its fullest potential, the primary vessel must be accessible during the entire visit to the park. This requires space at the dock at Garden Key. However, the permit system for private vessels would require all those vessels to come in to the dock at Garden Key, which will strain the dock facility even without the concessioner vessel being there. An extension of the existing dock for the concession vessel or alternative docking facilities would be required. The ferry concession contract would call for the concessioner to pay for the construction of the new dock. Although the dock would belong to the National Park Service, the concessioner would bear the costs to build the dock. The concessioner would then be assigned use of the dock for a term sufficient to recover the investment.

Other commercial uses in the park would be authorized by commercial use authorizations. These other guides would provide overnight/multiday commercial tours. The number of operators would not exceed 30 or the capacity of the resources to accommodate the use, which would be determined by monitoring. No facilities would be dedicated to these operators.

Sailing excursions would be authorized and limited to 20 to 25 visitors per trip. Fishing charters in six-pack boats for fishing in the natural/cultural zone only would be issued permits and subject to specific regulations issued to protect fisheries resources as warranted. Commercial use authorizations would be issued to conduct wildlife tours, including birdwatching, that begin and end at Garden Key. Arrangements would have to be made to use the concessioner's ferry transportation (because only two operators would have permission to bring people to the park). All commercial use authorization holders would be subject to established carrying capacity restrictions for the use of sites and areas within the park (see tables 1-3 and appendix D).

The cooperating association would sell a limited selection of health and safety-related items, and limited educational and interpretive merchandise related to the interpretive themes of the park. The concessioner would not be authorized to sell any of these items on the boat whether in the park or en route.

PARK OPERATIONS AND FACILITIES

A high level of patrolling of visitor use would occur in the natural/ cultural zone and the research natural area zone due to the permit system and commercial tour operations proposed. To conduct/manage research and survey/ monitor resources, NPS staff would expend a moderate to high amount of effort.

Resource protection and interpretive training of all commercial operators would be required, calling for a moderate to high amount of effort by NPS staff. All private boaters obtaining permits would receive similar training, which would require a moderate to high amount of effort by NPS staff. NPS staff would conduct most tours of the fort, although trained commercial staff would conduct some. Visitor information would be available at a new contact station in Key West, requiring NPS staff commitment.

NPS staff would maintain most of the facilities in the park, although facilities assigned to concessioners would have facility maintenance included in their contracts.

A reservation system might be established for the campground on Garden Key to ensure that visitor expectations were met.

PARK ENTRANCE FEE

A park entrance fee would be instituted to help support the additional costs incurred for managing carrying capacities, visitor safety and enjoyment, resource protection activities, and monitoring. (The authority to charge fees may end; however, the park would charge an entrance fee as long as this authority exists.)

ALTERNATIVE E

ALTERNATIVE E =				
The servicewide mandates and policies	+	The parkwide management actions	+	The actions described below that support the concept for this particular alternative

OVERALL CONCEPT

Under this alternative, the majority of the park would be designated as a research natural area and managed accordingly, with primary emphasis on resource protection and conservation (see Alternative E map). The alternative recognizes the paramount importance of preserving the park's near-pristine and fragile ecological resources and takes steps to closely direct visitor activities that could result in resource degradation. Most visitor use would be highly structured through commercial service providers. The goal for commercial service operations would be to be self-contained, thus reducing the strain on the limited park facilities. . Private boaters would moor at Garden Key and join tour operations. The types and levels of visitor use would be managed to protect resources and the quality of the visitor experiences. The total numbers of visitors transported to the park by commercial operators would be consistent with the aggregated carrying capacity targets of individual visitor destinations (see tables1-3 and appendix D).

The research natural area zone in this alternative would be compatible with the ecological reserve that is proposed by the National Oceanic and Atmospheric Administration for the Florida Keys National Marine Sanctuary, having the same goals and subsequent constraints on fishing.

VISITOR EXPERIENCE

To achieve these objectives, visitation would be strictly managed throughout most of the park to reduce or avoid the adverse effects of park visitors on the fragile resource base. Overnight private boaters would need a permit. The numbers of visitors allowed in certain areas at any given time, restrictions on the size of boats, limitations on arrival times, etc. would be according to the carrying capacity determinations for each area. A park entrance fee would be charged. No recreational fishing would be allowed in the research natural area. Also in the research natural area, commercial boat operators would be required to use mooring buoys, and anchoring would be prohibited. Overnight anchoring/mooring would be allowed only in the historic preservation/adaptive use zone around Garden Key (see detail map of this zone in the chapter on alternative B).

Although a variety of challenging activities would be available to park visitors, most would find a highly structured experience as part of the guided tours. Visitor uses on and under the water would be highly directed and monitored by NPS and concession staff in this alternative. Opportunities for individual discovery or choice of activities would be limited and would instead fall more under the prerogative of the tour operator/guide.

Visitor uses on Garden and Loggerhead Keys would be highly structured under this alternative. The visitor experience would be enhanced by limiting the size of tour groups and the number of people at the swim beach and moat wall. On the remaining keys, a staff member would always accompany visitors.

Visitors would occasionally encounter NPS personnel, but most visitors would more frequently encounter concessioner or tour operator staff. Nevertheless, because visitation would be dispersed throughout the park, ample opportunities for quiet and solitude would be expected for all visitors.

Because this alternative places a premium on resource protection, the integrity of the resources likely to be encountered would be high, which in turn would enhance the overall quality of the visitor experience. The trade-off of a highly structured visitor experience would be the opportunity to experience relatively unaltered natural landscapes and seascapes, with little likelihood of encountering other groups or other visible/audible intrusions on the natural environment.

A high-quality experience would be further enhanced by many opportunities for visitors to receive education and interpretation at the Key West docking facilities, while en route to the park, at Fort Jefferson, and at all commercial tour sites. All visitors would have access to basic park orientation and resource protection education by NPS staff or concession operator. Visitors would also receive the benefit of new information coming to light as a result of research activities of park scientists and investigators.

RESOURCE PROTECTION

In most of the park, except within the historic preservation/adaptive use zone, the resource protection strategy would be to maintain the park's near-pristine, intact ecosystem. There would be extremely low tolerance for impacts of recreational use on marine or terrestrial resources, and visitor travel and behavior would be highly regulated. Through the National Park Service and through concessioners, visitors would receive a high level of education about resource protection issues. This would include appropriate behavior in and around sensitive natural and cultural resources, appropriate boat handling and navigation, and the benefits of controls and regulations. Resource protection education would be incorporated into most recreational activities, and those receiving private boat permits would receive such education as a part of the permitting process.

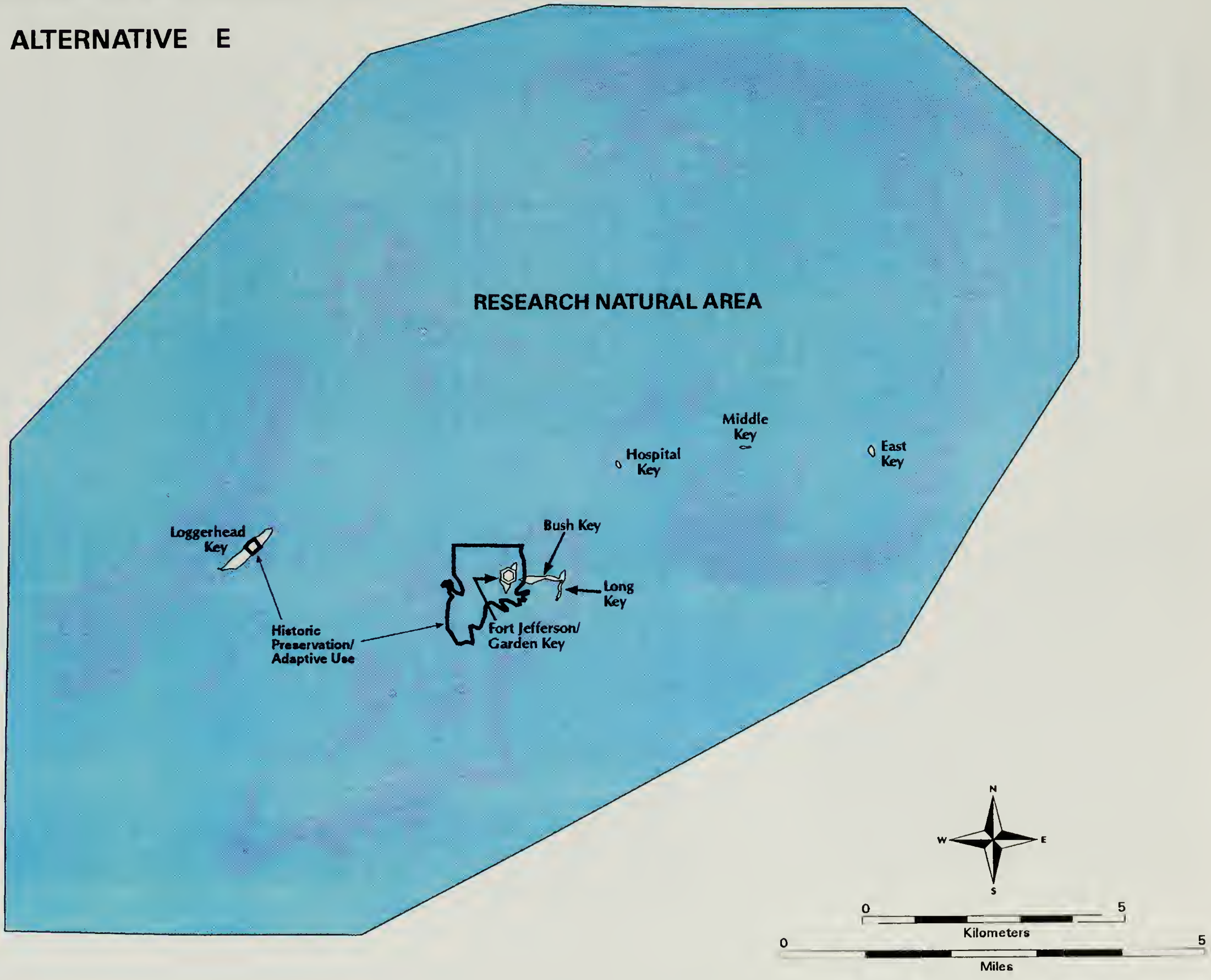
Concession services and restrictions on private boat travel would strictly control all visitor use outside of the historic preservation/adaptive use zone and would direct use to nonsensitive resources. Anchoring would be prohibited throughout the park to avoid indiscriminate damage to marine resources Although private boaters could still come to the park, to help protect the resources they would be required to moor at fixed buoys and use concession tour boats for intrapark transportation. Buoys would be placed only in areas where human use would pose little risk of resource damage.

With maximum protection of the park's near-pristine ecosystems and intact cultural resources, the park would provide outstanding opportunities for scientific research. All research within the research natural area would be nonmanipulative. Some sampling would be allowed, but no change in resource condition would be permitted. Manipulative research would be allowed elsewhere where consistent with park purposes and an approved plan.

Systematic, scheduled monitoring would document changes in species and communities to provide direction for resource management and research. Monitoring and research would be conducted on impacts on resources from visitor use, such as the affect on coral reefs from anchoring or concentrating visitor use with mooring buoys. Other monitoring actions would include determining population and biodiversity of marine and terrestrial species.

DRY TORTUGAS NATIONAL PARK

ALTERNATIVE E



Submerged Cultural Resource Strategy

The NPS Submerged Cultural Resources Unit has undertaken a comprehensive archeological survey and inventory of submerged sites within the park. The project began in 1992 with the compilation and assessment of natural and cultural resource data that provided the foundation for development of the survey research design. GIS (geographic information system) computer applications were incorporated into the survey methodology. The project is a model for a widearea survey of submerged NPS areas.

Using remote sensing magnetometer methods, surveys have been completed for more than 95% of the park's waters at depths of less than 30 feet. The technique was designed to detect ferrous metal objects, indicating potential site locations. Survey coverage of the entire park waters at all depths will eventually be completed.

A comprehensive and multidisciplinary monitoring program would be implemented to provide both annual site assessments and long-term detailed assessments for selected locations. As needed, more frequent assessments would evaluate reports of diver impacts, conditions following storms, etc. Site research would be conducted in accordance with approved research designs that support park management objectives. Archeological research and investigations would meet applicable NPS standards and would have minimal site impacts. Information would continue to be compiled in the GIS database.

The park would also implement measures to enhance site protection. Diving would be permitted only in approved areas by means of mooring buoys and other methods. Visitors would be directed away from sensitive site locations, and remote sensing surveillance systems would assist park patrol efforts to protect significant sites.

COMMERCIAL SERVICES

Air access would be provided by a single concession contract with the same limits as described in alternatives C and D. Water access, intrapark transportation, and tours would be provided as described in alternatives C and D. The activities, operations, facilities, and conditions described in alternatives C and D would also be applicable in this alternative. There would be no commercial use authorizations issued in this alternative. Recreational fishing would not be permitted in the park due to the extensive use of the research natural area zone, and the concessioner would offer all wildlife and birdwatching tours. Unless sailing excursions were provided in the concession contract, they would not occur in the park. The concessioner would extend the dock or use an alternative docking facility as in alternatives C and D and maintain all assigned facilities.

PARK OPERATIONS AND FACILITIES

A moderate to high level of NPS staff and resources would be required to manage and maintain facilities such as the dock, campground, fort, mooring buoys, and sanitary facilities. The dock at Garden Key or alternative docking facilities would be required accommodate private boaters who leave their boats to go on a commercial tour. A moderate to high NPS interpretive staff effort would be required to train concession employees and conduct fort tours. A moderate to high NPS patrol effort would be required to protect resources and monitor activities due to the structured concession services. Additional law enforcement staff would not be required due to the highly structured experiences planned.

PARK ENTRANCE FEE

A park entrance fee would be instituted to help support the additional costs incurred for managing carrying capacities, visitor safety and enjoyment, resource protection activities, and monitoring. (The authority to charge fees may end; however, the park would charge an entrance fee as long as this authority exists.)

MITIGATION MEASURES

Under any alternative, certain measures would be taken to mitigate, to the degree possible, impacts that might or would occur because of actions proposed. The following describes these mitigation measures.

CULTURAL RESOURCES

Although no adverse effects on cultural resources would be anticipated from any of the undertakings proposed in these alternatives, currently unidentified cultural resources might be discovered during project construction (e.g., perhaps in the vicinity of the boat dock should that structure be extended). Should archeological resources be discovered, work in that location would stop until the resources were properly recorded by the National Park Service and evaluated under the eligibility criteria of the National Register of Historic Places. If (in consultation with the Florida state historic preservation officer) the resources were determined eligible, appropriate measures would be implemented either to avoid further resource impacts or to mitigate the loss or disturbance of the resources.

MARINE LIFE AND WILDLIFE

A survey for sensitive marine species would be completed before any construction activities took place for extending the dock. If any species of concern were identified in the vicinity, appropriate mitigation measures would be undertaken.

If a shore-based permanent design were selected for expanding the dock, mitigating measures intended to protect water quality and marine life and wildlife from the effects of sedimentation, turbidity, and noise would be carried out during construction. The construction work area would be restricted to the minimum area needed, and direct disturbance would be avoided to the extent possible. Construction practices would be designed to have minimal impact on sensitive areas and to avoid these areas to the extent possible. Special care would be taken to avoid spills when using and handling fuels and lubricating oils. Construction noise would be kept to a minimum to avoid disturbing wildlife, and construction activities would not occur during bird and turtle nesting periods.

TRAFFIC

Construction activities involving rehabilitation of a building for the Key West multiagency visitor facility would be conducted in a manner that would ensure the least possible restriction of traffic from construction vehicles. Safety and convenience of the general public would be provided at all times.

VISITOR EXPERIENCE

The expansion of the visitor center would be carried out during a period of the year when visitation is low. Before construction activities begin, the park staff would develop an interim operations plan to deal with staff and visitor issues during the expansion project.

TABLE 5. SUMMARY OF PARKWIDE MANAGEMENT ACTIONS

Parkwide Management Actions, All Alternatives	
Visitor Experience	**Education/Interpretation/Information:** Emphasize understanding and appreciating the resources of the park and the appropriate use of those resources. Expand opportunities for education/interpretation/information at Key West, Fort Jefferson, and en route to the park with commercial operators. Improve visitor information, facilities, and outreach programs. **Visitor Facilities and Services:** Continue commercial vessel, plane or private boat access to the park. Continue most existing day use recreational activities, although fishing opportunities vary between alternatives (see table 6 below). Continue to require visitors to be self-sufficient. Establish interagency visitor facility in Key West. Keep facilities on Loggerhead Key for administrative and research use. Expand visitor center on Garden Key into one or two additional casemates; allow no other expansion or adaptation of historic buildings. Educate visitors through a combination of nonpersonal interpretive services (exhibits, waysides, radio and television media, and publications) and personal services (daily ranger-led interpretive programs, visitor center staffing, and law enforcement monitoring.
Resource Protection	**Natural Resources:** Support establishment of ecological reserve adjacent to the park. Protect opportunity to see the pristine night sky and protect the natural soundscape. **Cultural Resources:** Continue use of historic preservation/adaptive use zone areas at Garden Key and the central portion of Loggerhead Key. **Research:** Establish supplemental support for park research, such as storage, in Key West. Adaptively use some structures on Loggerhead Key as a modest support base for research in the park and the sanctuary. Require any additional in-park research facilities to be self-contained.
Park Operations	Continue use of patrol and supply boats and dock space at Key West for these boats. Develop an agreement with the U.S. Coast Guard to use pier and storage structure across from this dock space. Seek office space in vicinity of this dock space, possibly in conjunction with the U.S. Fish and Wildlife Service or the Florida Keys National Marine Sanctuary. Keep existing park-maintained employee quarters and utility systems in the fort. **Park Boundary and Buoy System:** Continue existing buoy navigational system. **Boundary Adjustments:** Continue existing boundary. **Housing:** Upgrade temporary and permanent employee housing in casemates with energy-efficient inserts that do not further degrade the historic walls of the casemates. Convert no additional casemates for housing or administrative uses. Establish permanent employee housing ashore, with some personnel rotating to the park. Accommodate researchers and other staff from agencies doing research within the modified casemates for the term of their needs as space permits. **Visitor Center:** Expand visitor center. **Utilities:** Do not expand utility system unless technological improvements make such expansion possible. Use renewable energy sources. **Communication Systems at the Park:** Continue to explore new technologies to improve communications, emphasizing improvements for visitor information and safety. **Necessary and Appropriate Commercial Activities:** Manage commercial activities within the capacity of the resources to withstand use.

Table 6: Summary of Alternative Actions

	Alternative A: Continuation of Current Management and Trends	Alternative B: Initiate Carrying Capacities, Continue Concessions and CUA Permits as existing	Alternative C: Initiate Research Natural Area (RNA) and Expand Commercial Services (Proposed Action)	Alternative D: Align RNA zone and Sanctuary Reserve; Expand Commercial Services	Alternative E: All RNA zone except Garden Key and Expand Commercial Services
Visitor Activities Allowed	Recreational fishing, swimming, snorkeling, diving, boating, and fort tours.	Same as alternative A.	No recreational fishing in research natural area zone — only swimming, snorkeling, diving, boating, and fort tours. Private boating would be permitted in the research natural area zone by permit.	Same as alternative C, except no private boating would be permitted in the research natural area.	Same as alternative D.
Tolerance for Resource Degradation	Low, but few controls are in place to limit damage from overuse or impacts from visitor use.	Low. Visitor numbers at one place at one time would be set to control damage. Monitoring would be in place.	Very low. Visitor numbers at one place at one time would be set to control damage. Concession staff would manage use in RNA zone. Use would be dispersed. Permits would be required for private boaters. Monitoring would be in place.	Same as alternative C.	Extremely low. Visitor numbers at one place at one time would be set to control damage. Concession staff would manage use in larger RNA zone. Use would be dispersed. Permits would be required for private boaters. Monitoring would be in place.
Commercial Services	Would be by CUA permits, with limits on total visitors transported by large vessels only (100 total).	Would be by CUA permits with capacity limits.	Would be by two exclusive concession contracts for all travel to park and in-park services. Tours that begin and end outside of park would be authorized by CUA permits.	Same as alternative C.	Same as alternative C except there would be no CUA permits authorized.

	Alternative A: Continuation of Current Management and Trends	Alternative B: Initiate Carrying Capacities, Continue Concessions and CUA Permits as existing	Alternative C: Initiate Research Natural Area (RNA) and Expand Commercial Services (Proposed Action)	Alternative D: Align RNA zone and Sanctuary Reserve; Expand Commercial Services	Alternative E: All RNA zone except Garden Key and Expand Commercial Services
Entrance Fee	No fee would be charged.	As authorized, an entrance fee would be instituted.	Same as alternative B.	Same as alternative B.	Same as alternative B.
Ability of Visitors to Visit Multiple Locations in the Park	Most visitors would be limited to Garden Key.	Most visitors would be limited to Garden Key.	Concessioners would be required to offer opportunities to visit selected sites throughout park. Private boaters would need to obtain permits for activities throughout the park, including the research natural area zone.	Same as alternative C except that all visits to destinations in the research natural area zone would be by guided tour only (no private boaters would be allowed).	Same as alternative C, except that private boaters would be required to join a highly structured, managed tour to visit most of the park.
Opportunity for Challenge/Adventure	High (for private boaters) to low (for tour visitors)	High (for private boaters) to low (for tour visitors)	High	High	Moderate
Opportunity for Solitude	Low	Low	Very high	Very high	Very high
Noise Levels for Visitors	Moderate, especially from boats and other visitors.	Same as alternative A.	Very low except at fort.	Same as alternative C.	Same as alternative C.
Permits for Private Boaters Required?	No	No	Yes	Yes	Yes

	ALTERNATIVE A: CONTINUATION OF CURRENT MANAGEMENT AND TRENDS	ALTERNATIVE B: INITIATE CARRYING CAPACITIES, CONTINUE CONCESSIONS AND CUA PERMITS AS EXISTING	ALTERNATIVE C: INITIATE RESEARCH NATURAL AREA (RNA) AND EXPAND COMMERCIAL SERVICES (PROPOSED ACTION)	ALTERNATIVE D: ALIGN RNA ZONE AND SANCTUARY RESERVE; EXPAND COMMERCIAL SERVICES	ALTERNATIVE E: ALL RNA ZONE EXCEPT GARDEN KEY AND EXPAND COMMERCIAL SERVICES
Mooring/Anchoring	Anchoring permitted throughout park.	Anchoring would be permitted throughout park.	No anchoring would be permitted in research natural area zone only; mooring would be permitted in the research natural area zone by permit only. Overnight anchoring would be permitted only in the historic preservation/ adaptive use zone.	No anchoring would be permitted in the research natural area zone. Mooring would be permitted in the research natural area zone only for the concessioner. Overnight anchoring would be permitted only in the historic preservation/ adaptive use zone.	No anchoring would be permitted in the research natural area zone. Mooring would be permitted in the research natural area zone only for the concessioner. Overnight anchoring would be permitted only in the historic preservation/ adaptive use zone.
Encounters with Others	High (for tour visitors) to low (for private boaters)	High (for tour visitors) to low (for private boaters)	Moderate at Garden Key. Low at other destinations.	Same as alternative C.	Same as alternative C.
Level of Interpretation	Moderate; some orientation on ferry tour. Fort tours would be available.	Same as alternative A.	High, especially on RNA zone tours and when obtaining permits for private boats.	Same as alternative C.	Same as alternative C.
Level of Resource Monitoring	Intermittent	Systematic monitoring of specific resource indicators and standards.	Same as alternative B.	Same as alternative B.	Same as alternative B.
Level of Visitor Use Patrols	High need but limited staffing	High	Moderate	Low to moderate	Low

A matrix summarizing and comparing the impacts of implementing the various alternative management plans is given below.

TABLE 7. SUMMARY OF IMPACTS

This table is a brief comparison of the alternative-specific impacts. For information on topics such as the cumulative, unavoidable, irreversible/irretrievable impacts, please refer to the narrative text.

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B	ALTERNATIVE C – PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
IMPACTS ON NATURAL RESOURCES					
Essential and Unique Habitats					
Coral Reefs	The current high levels of unrestricted boat access and use within all areas of the park under this alternative would continue to cause major short- and long-term adverse localized impacts on coral reefs. Current levels of unrestricted access to coral reefs, particularly coral reefs in shallow areas, by fishermen, scuba divers, snorkelers, and swimmers result in moderate levels of long-term adverse impacts on the reefs. The continuation of these use patterns would allow stress and damage accumulation in conjunction with boat damage. Because alternative A provides no research natural area zone protection to the park's essential and unique habitats, this alternative would continue to provide no improvement	Management tools available under alternative B would control the maximum number of visitors in certain areas of the park. If in the unrestricted areas established standards for resource quality for the management zone were exceeded, additional use restrictions would be established to prevent further impairment of these resources. Because alternative B provides no research natural area zone protection to the park's essential and unique habitats, this alternative would provide little improvement over current conditions, but would enhance protection from the impacts of future increased use.	The introduction of a research natural area zone in the park would significantly reduce the short- and long-term adverse impacts on coral reefs within that zone. This level of research natural area zone protection would provide a significant increase in habitat quality compared to alternative A, and would protect several extraordinary coral reef formations (e.g., Loggerhead Forest). This increased protection would have a beneficial impact on reef formation and associated aquatic life in the research natural area. Aquatic habitats outside this zone would continue to face moderate to major long-term adverse impacts	This level of research natural area protection would provide a significant increase in habitat quality compared to alternative A. The aquatic habitats outside the boundaries of the research natural area zone would still face moderate to major long-term adverse impacts due to use by boaters, fishermen, scuba divers, snorkelers, and swimmers.	The creation of a research natural area zone for essentially the entire park would almost eliminate the short-and long-term adverse impacts on coral reefs. This level of research natural area zone protection would provide a significant increase in habitat quality compared to alternative A.

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
	over current conditions or protection from future increased use.				
Sea Grass Beds and Hardbottom Communities	The current high levels of unrestricted boat use and access within all areas of the park under alternative A would continue to cause major short- and moderate long-term adverse localized impacts on sea grass beds and hardbottom communities.	Same as Coral Reefs above.	Same as Coral Reefs above.	Same as Coral Reefs above.	Same as Coral Reefs above.

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
Sand Bottoms	Minor short-term impacts would occur when boats are run over shallow areas, causing increased turbidity in surrounding areas. Future increases in boat use would pose moderate short-term impacts because there are no restrictions on boat use or access under this alternative.	Same as Coral Reefs above	Same as Coral Reefs above.	Same as Coral Reefs above.	Same as Coral Reefs above.
Terrestrial Habitats	Unmonitored use of terrestrial habitats for picnicking, camping, wildlife viewing, walking, etc. would likely continue to cause major short-term and moderate long-term deterioration of island flora. The prevention of any further facility construction would provide some level of protection to the terrestrial resources by preventing the major damage caused by such an undertaking.	Improved monitoring of the use of terrestrial habitats for picnicking, camping, wildlife viewing, walking, etc. would reduce some of the major short-term and moderate long-term deterioration of island flora due to these uses. If established standards for resource quality for the management zone were exceeded, additional use restrictions would be established to prevent further impairment of these resources. The prevention of any further facility construction would provide some level of protection to the terrestrial resources by preventing the major damage caused by such an undertaking.	Monitored and/or restricted access to much of the terrestrial habitat and the use of guided tours would provide increased protection to land-based resources compared to alternative A. The restriction of any further construction of facilities, except dock expansion, and the shifting of visitor loads to commercial services would provide increased protection to the essential habitats of the park, further decreasing long-term adverse impacts.	Same as alternative C.	Same as alternative C, but for most of the park.
Fishery Resources					
Exploited Reef Fish	Current levels of exploitation would continue to result in long-term major adverse impacts on the exploited reef	Current levels of exploitation would continue to result in short- and long-term major adverse impacts	The research natural area would provide greatly increased levels of protection for 88% of the	The research natural area would provide greatly increased levels of protection for 80% of the	Alternative E would protect 100% of the reef fish species in the park and thus provide stability to the community

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
	fish stocks in the park, reducing the value of the park to almost all users. As reef fish stocks begin to collapse and become more rare, the diversity, abundance, size, distribution, and balance of the reef fish community would become further degraded. Because alternative A contains no research natural area zone, it offers no further protection to the diversity of the reef fish community or protection from increased impacts.	on the exploited reef fish populations in the park, reducing the value of the park to almost all user groups, including fishermen, scuba divers, and snorkelers.	reef fish species found in the park and 97% of the species in the snapper-grouper-grunt complex. There would be a major short-term and minor long-term adverse impact on fishing yields in the park; however, these yields would be higher and more sustainable over the long term. These larger fish could leave the research natural area boundary at times, which would benefit recreational trophy and commercial fishing yields in waters adjacent to the research natural area zone. Alternative C would provide excellent protection to the exploited reef fish stocks (groupers, snappers, and grunts) and would result in only moderate long-term risks of adverse impacts on the population due to expected fishing around the research natural area.	reef fish species found in the park and 83% of the species in the snapper-grouper-grunt complex. There would be a major short-term and minor long-term adverse impact on fishery yields taken in the park; however, these yields would be sustainable over the long term. These larger fish could leave the research natural area boundary at times, which would benefit recreational trophy and commercial fishing yields in waters adjacent to the research natural area. Alternative D would provide excellent protection to the exploited reef fish stocks (groupers, snappers, and grunts) and would result in only moderate long-term risks of adverse impacts on the reef fish population due to expected fishing around the research natural area.	and excellent protection to the exploited reef fish populations (groupers, snappers, and grunts). Implementing this alternative would result in only minor long-term risks of adverse impacts on those populations due to fishing around the park. With no fishing allowed in most all of the park, fishery yields would be nearly eliminated. The presence of substantially larger individual fish within the park would benefit recreational trophy and commercial fishermen in waters adjacent to the park.

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
Other Species	The nonexploited species of reef fish would be impacted indirectly, through habitat degradation and the dynamics of the exploited reef fishery, and directly through accidental catches by recreational fisherman. The delicate balance of the coral reef ecosystem is easily upset by the impacts of habitat degradation and selective fishing on key predator species. The combination of these factors, under current levels of park access and fishing mortality, would continue to present a major short- and long-term adverse impact on these exploited and unexploited fish populations.	Because alternative B contains no RNA zone, it offers no further protection to the diversity, abundance, size, and distribution of the reef fish community or protection from increased impacts. The combination of these factors, under current levels of park access and fishing mortality, would result in major short- and long-term adverse impacts on these populations.	The creation of the research natural area would also provide major short-term and long-term benefits to the diversity, abundance, size, and distribution of unexploited and protected/threatened fish and invertebrate populations through the protection of coral reef habitats and the elimination of accidental-catch mortality in the research natural area zone.	Same as alternative C.	Same as alternative C.

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B	ALTERNATIVE C – PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
Wildlife Resources					
Birds	Although most of the birds and their nesting sites are currently protected, the level of human use and access within the park would continue to present major long-term adverse impacts on the adult birds, because these uses often result in death. The major sources of degradation and/or loss of nesting sites include disturbance by visitors, noise from planes and boats, exotic plant invasions, erosion, and exotic rats that eat eggs and young, resulting in major short- and long-term damages.	Alternative B would slightly increase protection to the birds and their nesting sites in the park due to limiting overcrowding in areas, spreading out resource use, and applying management tools to limit visitor impacts after certain management zone standards have been reached. Application of the special protection zone to highly sensitive sites during critical nesting periods would significantly limit adverse impacts.	Measures to control access to land-based environments in the research natural area through guided tours under alternative C should significantly reduce short- and long-term adverse impacts on bird nests and eggs. Eliminating fishing and restricting boat use within the research natural area zone would greatly reduce the risks to birds that are caused by boating and fishing.	Same as alternative C.	Measures to control access to land-based environments through guided tours under alternative E should significantly reduce short-term and long-term adverse impacts on bird nests and eggs. Eliminating fishing and restricting boat use within almost the entire park would nearly eliminate the risks to birds that are caused by boating and fishing.
Turtles	The current levels and access throughout the park of recreational boaters with little knowledge of the area would continue to result in major short- and long-term adverse impacts on turtles swimming in the park due to mortality from collisions with boats and/or propellers. Although much time and effort is put into protecting nesting turtles and their nests, the current levels of visitor use, noise, and unmonitored access to many	Same as Birds above. Also, unlimited boater access to the park would still present major short- and long-term adverse impacts on swimming turtles.	Measures to control access to land-based environments in the research natural area through guided tours under alternative C should significantly reduce short- and long-term adverse impacts on turtle nests and eggs. Eliminating fishing and restricting boat use within the research natural area zone would greatly reduce the risks to swimming turtles that are caused by boating and fishing.	Same as alternative C.	Measures to control access to land-based environments through guided tours under alternative E should significantly reduce short-term and long-term adverse impacts on turtle nests and eggs. Eliminating fishing and restricting boat use within the almost the entire park would nearly eliminate the risks to swimming turtles that are caused by boating and fishing.

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
	beach areas would continue to be a moderate short- and long-term threat to the nesting behaviors and nests of the turtles.				
Marine Mammals	Current levels of boat use and unrestricted access to all portions of the park, particularly areas frequented by manatees and coastal dolphins, would continue to present major short- and long-term adverse impacts on marine mammals from collisions and propeller contact, particularly for very young and old individuals that are less mobile and less able to avoid collisions.	Alternative B would slightly increase protection to the marine mammals in the park due to spreading out resource use and applying management tools to limit visitor impacts after certain management zone standards have been reached. However, the management zone standards allow some adverse impacts. Unlimited boater access to the park would still present major short- and long-term adverse impacts on marine mammals.	Eliminating fishing and restricting boat use within the research natural area zone would greatly reduce the risks to marine mammals that are caused by boating and fishing.	Same as alternative C.	Eliminating fishing and restricting boat use within the park would nearly eliminate the risks to marine mammals that are caused by boating and fishing.
Environmental Setting					
Soundscape and Night Lighting	The current levels of visitation focused during certain periods of the year provide a moderate short-term adverse impact on the soundscape and the opportunities to see the night sky in the park. Noise levels also threaten successful turtle and bird nesting. Visitor education and compliance with rules would mitigate these impacts somewhat. As levels of	The current levels of visitation during periods of the year result in a moderate short-term adverse impact on the natural sounds and night lighting in the park. However, as levels of visitation increase, the application of management tools and standards (visitor capacity limitations within areas, the reduction of boat use, and controls on noise levels) would ensure the	Visitor capacity limitations within areas, the reduction of boat use, and controls on noise levels) would ensure the protection of the natural soundscape and opportunities to see the night sky. Low tolerance for activities that degrade the natural soundscape and lighting in the park would decrease these impacts, as would education and compliance with night sky and	Same as alternative C.	Same as alternative C.

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B	ALTERNATIVE C – PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
	visitation increase, the current management plan would be insufficient to control the escalation in light and noise pollution and would present a major short-term risk. Low tolerance for activities that degrade the natural soundscape and the natural lighting in the park would decrease these impacts, as would education and compliance with night sky and soundscape protection regulations.	protection of the night view of the sky and the natural soundscape.	soundscape protection regulations.		
Wetlands	There would be no impacts on wetlands.	There would be no impacts on wetlands.	Potential impacts would occur on the marine intertidal unconsolidated shore wetlands around Garden Key as a result of dock expansion. The extent of impacts cannot be determined at this time.	Same as alternative C.	Same as alternative C.
Water Quality	The water quality within the park constantly faces the potential of a minor or major oil or fuel spill caused by grounding of recreational boats, and this threat constitutes a potential major short-term and moderate long-term adverse impact on the park. Under alternative A, this threat would continue. The restriction of any further construction of facilities would provide increased protection of water quality.	Water quality in the park always faces the potential of a minor or major oil or fuel spill caused by grounding of recreational boats; this risk would continue under alternative B. However, as visitation increases, applying management tools and standards (visitor capacity limitations in areas and the reduction of boat use) would help decrease the risk to water quality. The restriction on constructing facilities would provide more protection of water quality.	In the research natural area, restricted private boat use would decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.). The restriction of any further construction of facilities, except the dock expansion, would provide increased protection of water quality.	Same as alternative C.	Restricted private boat use throughout most of the park would greatly decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.). The restriction of any further construction of facilities, except the dock expansion, would provide increased protection of water quality.

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
IMPACTS ON CULTURAL RESOURCES					
	Cultural resources (e.g., shipwreck sites, historic structures, etc.) might be adversely affected by increasing park visitation if current staffing/ funding levels provide insufficient protection. Proposed rehabilitation of the Fort Jefferson visitor center and staff/ administrative use quarters, along with ongoing preservation undertakings, would have no adverse effect on significant historic properties.	Cultural resources would receive moderate long-term benefits by limiting visitor numbers in sensitive areas of the park, adopting the *Submerged Cultural Resources Strategy*, and providing adequate staff to carry out and enforce resource protection measures. Proposed rehabilitation of the Fort Jefferson visitor center and staff/ administrative use quarters, along with ongoing preservation undertakings, would have no adverse effect on significant historic properties.	Cultural resources would receive major long-term benefits by limiting visitor numbers in sensitive areas of the park, adopting the *Submerged Cultural Resources Strategy*, requiring visitor permits, and adopting a research natural area zone. Proposed rehabilitation of the Fort Jefferson visitor center and staff/ administrative use quarters, along with ongoing preservation undertakings, would have no adverse effect on significant historic properties.	Cultural resources would receive major long-term benefits by limiting visitor numbers in sensitive areas of the park, adopting the *Submerged Cultural Resources Strategy*, requiring visitor permits, and adopting a research natural area zone (and prohibiting private boat access within this zone). Proposed rehabilitation of the Fort Jefferson visitor center and staff/administrative use quarters, along with ongoing preservation undertakings, would have no adverse effect on significant historic properties.	Cultural resources would receive major long-term benefits by limiting visitor numbers in sensitive areas, adopting the *Submerged Cultural Resources Strategy*, requiring visitor permits, and adopting a widespread research natural area zone. Proposed rehabilitation of the Fort Jefferson visitor center and staff/administrative use quarters, along with ongoing preservation undertakings, would have no adverse effect on significant historic properties.
IMPACTS ON VISITOR EXPERIENCE					
	Increases in the number of park visitors could result in minor to moderate long-term adverse impacts on the visitor experience. NPS interpretive programs would still be conducted on a limited basis, especially in contacting private boaters. Establishing a visitor contact facility in Key West would have a major long-term beneficial impact on the visitor experience.	Establishing maximum numbers of visitors at specific sites and dispersing them more broadly would improve opportunities for solitude, tranquility, challenge, and adventure and reduce crowding — a long-term minor beneficial impact. Establishing a visitor contact facility in Key West would have a major long-term beneficial impact on the visitor experience.	Establishing opportunities for tour visitors to go beyond Garden Key and see/ experience near-pristine resources, solitude, tranquility, and challenge would be a long-term moderate to major beneficial impact. Prohibiting recreational fishing in and requiring a permit for entering the research natural area would have a long-term minor effect on recreational	Same as alternative C except that prohibiting fishing and boating in the research natural area zone would have long-term minor adverse impacts on visitors seeking these opportunities in the park.	Same as alternative C except that prohibiting fishing and boating in the park would have long-term moderate adverse effects on visitors seeking these opportunities in the park. Also, private boaters who currently might experience a solitary remote marine environment would experience a moderate long-term impact due to the loss of freedom now available.

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
	Implementing interpretive and wayside exhibit plans would have major long-tem benefits on the visitor experience. Visitors would benefit from enhanced information as a result of NPS coordination with other south Florida planning efforts.	Implementing interpretive and wayside exhibit plans would have major long-tem benefits on the visitor experience. Visitors would benefit from increased information as a result of NPS coordination with other south Florida planning efforts.	fishermen and a short-term minor adverse effect on some private boaters. Establishing a visitor contact facility in Key West, educating visitors on tours, and requiring private boaters to have a permit would have a major long-term beneficial impact on the visitor experience. Implementing interpretive and wayside exhibit plans would have major long-tem benefits on the visitor experience. Visitors would benefit from enhanced information as a result of NPS coordination with other south Florida planning efforts. Future fishermen would benefit from the establishment of a zone that would improve spawning population.		

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B	ALTERNATIVE C – PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT					
	Implementing alternative A would have negligible effects on county and regional tourism or recreational opportunities. Establishing the visitor contact facility in Key West might attract more visitors to Key West, resulting in minor long-term benefits for the county's economy. Impacts on commercial use authorization holders and charter fishing operators would be anticipated to be negligible.	Implementing alternative B would have negligible effects on county or regional tourism or recreational opportunities. Establishing the visitor contact facility in Key West might attract more visitors to Key West, resulting in minor long-term benefits for the county's economy. Limiting use in selected areas might decrease the level of commercial use in the park, and therefore commercial operators' incomes, especially new operators. Impacts on charter fishing operators would be negligible.	Implementing alternative C would have negligible effects on county or regional tourism or recreational opportunities. Establishing the visitor contact facility in Key West might attract more visitors to Key West, resulting in minor long-term benefits for the county's economy. Awarding a concessions contract to one ferryboat and one seaplane business would be a long-term major economic benefit to those businesses and a long-term major adverse impact on current operators who were not awarded the contracts. Establishing intrapark transportation would provide additional revenue opportunities for the concessioner and more employment opportunities in the county. Charter fishing operators could experience a minor reduction in revenues from eliminating recreational fishing from the research natural area of the park. However, other opportunities would be available for charter fishing operators in other nearby waters. The	Same as alternative C except that concessioner could increase income by picking up private boaters and taking them into the research natural area.	Implementing alternative E would have negligible effects on county or regional tourism or recreational opportunities. Establishing the visitor contact facility in Key West might attract more visitors to Key West, resulting in minor long-term benefits for the county's economy. Awarding a concessions contract to one ferryboat and one seaplane business would be a long-term major economic benefit to those businesses and a long-term major adverse impact on current operators who were not awarded the contracts. Establishing intrapark transportation, eliminating private boating from the park, and permitting the concessioner to provide all commercial services would provide additional revenue opportunities for the concessioner and more employment opportunities in the county. Charter fishing operators and other current CUA operators could experience a minor reduction in revenues because of the requirement

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
			cumulative impacts of establishing no-fishing areas would have moderate long-term beneficial impacts on marine populations, recreational and commercial fishing, and the regional economy.		for all activities in the park to be done through the two concessioners. The cumulative impacts of establishing no-fishing areas would have moderate long-term beneficial impacts on marine populations, recreational and commercial fishing, and the regional economy.

IMPACT TOPIC	ALTERNATIVE A — NO ACTION	ALTERNATIVE B	ALTERNATIVE C — PROPOSED ACTION	ALTERNATIVE D	ALTERNATIVE E
IMPACTS ON PARK OPERATIONS AND FACILITIES					
	Implementing alternative A would have long-term moderate adverse impacts on park operations and facilities in terms of the staff's ability to meet the demands of increasing visitor numbers. Installing energy-efficient insets in the casemates, improving the utilities and communications systems, providing adequate office and storage space, using renewable energy resources, and dispersing pre-visit information would have major long-term beneficial impacts on park operations and facilities. Visitor facilities would not accommodate all visitors during peak periods.	Implementing alternative B would have long-term moderate beneficial impacts on park operations as a result of increasing staff numbers and establishing visitor capacities at selected park sites. Installing energy-efficient insets in the casemates, improving the utilities and communications systems, providing adequate office and storage space, using renewable energy resources, and dispersing pre-visit information would have major long-term beneficial impacts on park operations and facilities. Using mooring buoys would be labor intensive and require special equipment, knowledgeable personnel, and a dedicated cyclic budget — a minor adverse impact under this alternative.	Implementing alternative C would have long-term moderate to high adverse impacts on park operations due to establishing visitor capacities at selected sites and increasing staff numbers. More patrols would be required. Operations would be more efficient and safe, especially with the dock extension. The burden on the park's limited facilities would be eased with a concession self-contained vessel. Using mooring buoys would be labor intensive and require special equipment, knowledgeable personnel, and a dedicated cyclic budget — a moderate to high adverse impact. Awarding concession contracts would increase the NPS staff time needed to manage and monitor the commercial services program. Concessioners would provide a park funding source.	Same as alternative C.	Same as alternative C except that NPS effort to manage the commercial services program would be further increased and implementing and maintaining the mooring buoy system would be a major impact on park operations under this alternative.

RECOMMENDATIONS FOR FURTHER RESEARCH AND PLANNING

Natural resource management programs would be based on research coordinated with the Florida Keys National Marine Sanctuary, the state, the US Fish and Wildlife Service, the U.S. Biological Service, and others. Priorities for research would be based on the park's primary purpose to preserve and protect the natural, historic, scenic, marine, and scientific values of the area while balancing opportunities for people to learn from them and enjoy and be inspired by them. To prevent significant long-term adverse impacts in the park, the following topics would require more study:

- threatened or endangered plants and animals and their habitats
- water quality and potential sources of pollution
- long-term monitoring of impacts of human use on resources
- long-term monitoring of impacts of natural forces on resources
- refinement of indicator species and communities
- effects of recreational fishing in the zones in which it is allowed
- soundscape management
- effects of establishment of areas in which no fishing is allowed
- historic structure reports
- cultural landscape reports
- archeological research design and data recovery reports
- submerged cultural resources plan

There is an unusually strong emphasis on public education and interpretation in Dry Tortugas National Park's enabling legislation, significance statements, and mission goals. The first thing stated in the park's enabling legislation (PL 102-525) is that the park has been established "to preserve and protect for the education, inspiration, and enjoyment of present and future generations..." Within the management purposes identified in the legislation, interpretation is twice mentioned. In addition to historical, cultural and natural values, two of the park's statements of significance are directly tied to its educational value.

Interpretation has many roles in a national park. Interpretation is a form of resource management — educating visitors to reduce resource damage. However, the greater goal of interpretation is to provide visitors with an understanding and appreciation of the significance of Dry Tortugas National Park, its resources, and the roles of those resources in the ecosystem, history, and the world. Beyond that, an overlying role is to actively contribute to increasing a scientifically, historically, and culturally literate society — a constituency that supports and understands the value of preservation and conservation. The future of Dry Tortugas National Park depends on not only responsible management, but also an informed and involved public. Interpretation is a NPS tool that fosters public awareness and appreciation of the natural and historical features of the parks, promotes an understanding of ecological concepts and relevance of historical knowledge, and instills a sense of stewardship towards the national park system, the earth, and all of its inhabitants.

The following plans and documents might be completed to help implement the recommendations of this management plan

- concessions contract prospectus
- water resource management plan (includes water quality monitoring program plan)
- research plan
- vegetation management plan
- rare, threatened, and endangered species management plan
- park interpretation plan
- collections management plans
- park administrative history
- visitor use management plan
- exhibit plans (an Everglades/Dry Tortugas wayside exhibit plan is in progress)
- cultural resource management plan, with submerged cultural resources component
- soundscape management plan
- resource management plan
- regulations

ACTIONS CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

The fisheries protection practice called "catch and release" — that is to catch fish but to return them to the water immediately, was considered but rejected as a protection strategy. Data show that injury and mortality rates to fish caught and then released do not support the intent and goals of the research natural area zone. If management in this zone and in the similarly managed areas of the Florida Keys National Marine Sanctuary are successful, catch and release in the natural/cultural and the historic preservation/adaptive use zones is unnecessary. This management action was therefore eliminated from further study.

There were no other actions that were beyond the scope of this plan that were considered and then eliminated.

AFFECTED ENVIRONMENT

Dry Tortugas National Park, a 100-square-mile (250-square-kilometer) area about 70 miles (118 kilometers) is west of Key West, Florida. The park is a unique tropical marine environment of national significance, renowned for its productive coral reef ecosystem, diverse and abundant natural resources, and spectacular scenic beauty. The park is comprised of seven atoll-like tropical islands that are in an elliptical pattern. The elevation of land masses range from sea level to 82 feet (25 meters) below sea level in the park — part of the extension of the Florida shelf. The Dry Tortugas region extends westward from the Marquesas Keys to the southwestern end of the Florida Keys, which is a 236-mile- (380-kilometer-) long chain of about 1,200 islands that separates the shallow waters of Florida Bay to the north from the Atlantic Ocean in the east and the Gulf of Mexico and Straits of Florida in the west and south, respectively.

The Tortugas region plays a critical role in the function and dynamics of the larger Florida Keys coral reef ecosystem. The Florida Keys encompass many varied interdependent habitats including subtropical embayments and lagoons, mangrove stands, coral islands, sponge and gorgonian and sea grass beds, and coral reefs. The abundance, distribution, and productivity of many natural resources, such as reef fishes, macroinvertebrates, soft and hard corals, sea grasses, etc., are tightly linked to the oceanographic environment and biophysical connections between these habitats.

Spawning migrations, oceanographic processes, and the life stages of many key reef species help to provide critical sources of essential nutrients, foods, larvae, and adult animals that support the region's productivity (Lee et al. 1994, Lindeman et al. 2000a). Oceanographic features such as gyres, eddys, and seasonal current reversals (Lee et al. 1999) facilitate transport and dispersion of larvae to suitable downstream coastal bays and nearshore habitats. These nursery areas in Biscayne and Everglades National Parks and Florida Bay provide sanctuary for spiny lobster and many juvenile fishes that occupy reefs as adults, including barracuda, hogfish, lobsters, pink shrimp, many grunts, and most snappers and groupers (Chester and Thayer 1990). The region also provides essential food resources for a host of key predator-prey interactions in the coral reef ecosystem, and for support of migrating sea turtles, sea birds, marine mammals, and large fishlike mackerels, tunas, and billfishes.

The unique biophysical environment of the Dry Tortugas National Park supports a rich base of natural resources, including an extraordinary diversity of essential and unique habitats, fishery resources, wildlife resources, and environmental settings. As in the Florida Keys National Marine Sanctuary's environmental impact statement, a summary of scientific studies conducted at the park can be found in Schmidt and Pikula's annotated bibliography (NPS 1997b).

ESSENTIAL AND UNIQUE HABITATS

Coral Reefs

Coral reefs are among the most diverse and biologically complex ecosystems on earth. These "rainforests of the sea" provide economic and environmental benefits to millions of people as areas of natural beauty and recreation, sources of food, jobs, chemicals, pharmaceuticals, and shoreline protection. Now under threat from multiple stresses that are overwhelming their natural resilience, coral reefs are deteriorating worldwide at alarming rates. An estimated 10% of the world's reefs have already been lost and 60% are threatened by bleaching, disease, and a variety of human activities including shoreline development, polluted runoff from agricultural and land-use practices, ship groundings, overharvesting and destructive fishing practices, and global climate change. Sustained downward trends in coral reef health suggest that these ancient ecosystems are in peril.

The coral reefs of the park and the Tortugas region have some of the best developed and most luxuriant corals found in the Caribbean. The Tortugas region has a full range of hard and soft corals with more than 75 species, some of which are rare elsewhere (Miller and Swanson 2000; table A1). In fact, some of the most pristine and vibrant portions of the Florida Keys coral reef ecosystem are protected within the park's boundaries, and others are just outside park boundaries on the Tortugas Bank.

The park and surrounding region contain both deep and shallow reef formations that support different fish faunas as well as different life stages (larval, juvenile, and adult). These different stages have different distribution patterns among habitats. A unique feature is the exceptional deep coral reef resources of the area, e.g., "Sherwood Forest" and "Loggerhead Forest." These luxuriant coral formations are exquisitely developed and may be the oldest living coral reefs found throughout the Americas (R.N. Ginsburg, Professor of Marine Geology, pers. comm., 1999). These formations provide excellent habitat for reef fishes and lobsters and are well known by fishermen for their productivity.

These resources also play a vital role in South Florida's efforts to recover and maintain a balanced and sustainable marine ecosystem. However, observations of coral disease outbreaks throughout the upper Keys, coupled with declining water quality, make coral reefs a particular concern (Porter and Meier 1992; Porter et al. 1994). Increased use and human contact may further diminish the quality and productivity of corals to the regional ecosystem.

Other Underwater (Benthic) Habitats

Other underwater habitats in the park include immense and relatively diverse hardbottom communities of sponges and gorgonians, many of which are unique to the Tortugas. Sea grasses provide unique links in nutritional cycles, cover that animals use to avoid predators, and the sustained production of debris that is essential to food web productivity. The Tortugas area has the highest diversity of sea grass species compared to waters around the Florida Keys (Fourqurean et al. 1999). Many of these habitats are extremely important to juvenile reef fishes. The park also contains large areas of sand and mixed-hardbottom communities. The distribution and abundance of these various communities are important considerations in resource management and assessment.

Underwater Habitat Distribution

The distribution of coral reef, hardbottom, and sea grass interpreted from aerial photographs and side-scan sonar are shown in figure B1 for both the park and the Tortugas Bank. Within the park, a mixture of shallow-water sea grasses, deepwater bare sand, and hardbottoms with moderate shallow-water patch and bank reef development prevail. The north and west areas of the Tortugas Bank form a mosaic of extensive, robust, deepwater reefs adjacent to low-relief, hardbottom and sand-covered areas (Bohnsack and McClellan 1998). The coral reef habitat is further broken down into four distinct reef types: patch reefs, fore reefs, reef flats, and deep reefs (appendix G, table A2a). Each of these reef types is used differentially by the reef fish community. The distribution of reef type and sea grass, sand, and hardbottom communities for the park only is shown on figure B2. The total area of each of these park habitats, by depth category, is shown in table A2b (appendix G). The deep reefs, although not represented on the map of figure B2 because they are too deep to be seen from aerial photos, are along the outer boundaries of the represented reef.

Table A1: List of stony coral, gorgonian, and sponge species sampled in the Florida Keys coral reef tract by NURC divers, 1998–99.

STONY CORALS (45 TAXA)

Phylum Cnidaria
Class Anthozoa
Orders Scleractinia & Milleporina
Acropora cervicornis
Acropora palmata
Agaricia agaricites
Agaricia fragilis
Agaricia humilis
Cladocora arbuscula
Colpophyllia natans
Dendrogyra cylindrus
Dichocoenia stokesi
Diploria clivosa
Diploria labyrinthiformis
Diploria strigosa
Eusmilia fastigiata
Favia fragum
Isophyllastrea rigida
Isophyllia sinuosa
Leptoseris cucullata
Madracis decactis
Madracis formosa
Madracis mirabilis
Manicina areolata
Meandrina meandrites
Millepora alcicornis
Millepora complanata
Montastraea annularis (I)
Montastraea faveolata (II)
Montastraea franksi (III)
Montastraea annularis spp.
Montastraea cavernosa
Mussa angulosa
Mycetophyllia aliciae
Mycetophyllia danaana
Mycetophyllia ferox
Mycetophyllia lamarckiana
Oculina diffusa
Porites astreoides
Porites branneri
Porites divaricata
Porites furcata
Porites porites
Scolymia spp.
Siderastrea radians
Siderastrea siderea
Solenastrea bournoni
Stephanocoenia michelinii

Gorgonians (30 Taxa)

Phylum Cnidaria
Class Anthozoa
Subclass Octocorallia
Briareum asbestinum
Erythropodium caribaeorum
Eunicea calyculata
Eunicea fusca
Eunicea knightii
Eunicea laciniata
Eunicea mammosa
Eunicea palmeri
Eunicea succinea
Eunicea tourneforti
Gorgonia ventalina
Muricea atlantica
Muricea elongata
Muricea muricata
Muriceopsis flavida
Plexaura flexuosa
Plexaura homomalla
Plexaurella dichotoma
Plexaurella grisea
Plexaurella nutans
Pseudoplexaura flagellosa
Pseudoplexaura porosa
Pseudoplexaura wagenaari
Pseudopterogorgia acerosa
Pseudopterogorgia americana
Pseudopterogorgia bipinnata
Pseudopterogorgia rigida
Pterogorgia anceps
Pterogorgia citrina
Pterogorgia guadalupensis

Sponges (59 Taxa)

Phylum Porifera
Class Demospongeae
Agelas clathrodes
Agelas conifera
Agelas dispar
Agelas schmidti
Agelas wiedenmayaari
Amphimedon compressa
Amphimedon viridis
Anthosigmella varians
Aplysina archeri
Aplysina cauliformis
Aplysina fistularis
Aplysina fulva
Aplysina lacunosa
Callyspongia plicifera
Callyspongia vaginalis
Chondrilla nucula
Chondrosia sp.
Cinachyra sp.
Clathria sp.
Cliona deletrix
Cliona langae
Cliona sp. (brown encrusting)
Cribochalina vasculum
Desmapsamma anchorata
Diplastrella megastellata
Dysidea etheria
Ectyoplasia ferox
Erylus formosus
Geodia neptuna
Haliclona hogarthi
Halisarca sp.
Holapsamma helwigi
Iotrochota birotulata
Ircinia campana
Ircinia felix
Ircinia strobilina
Monanchora barbadensis
Monanchora unguifera
Mycale laevis
Neofibularia notilangere
Niphates digitalis
Niphates erecta
Oligoceras hemorrhages
Pandaros acanthifolium
Plakortis angulospiculatis
Phorbas sp.
Pseudoceratina crassa
Pseuoaxinella lunaecharta
Ptilocaulis sp.
Rhaphidophlus venenosus
Siphonodictyon
Siphonodictyon siphonum
Spheciospongia vesparium
Spirastrella coccinea
Strongylacidon sp.
Ulosa ruetzleri
Verongula gigantea
Verongula rigida
Xestospongia muta

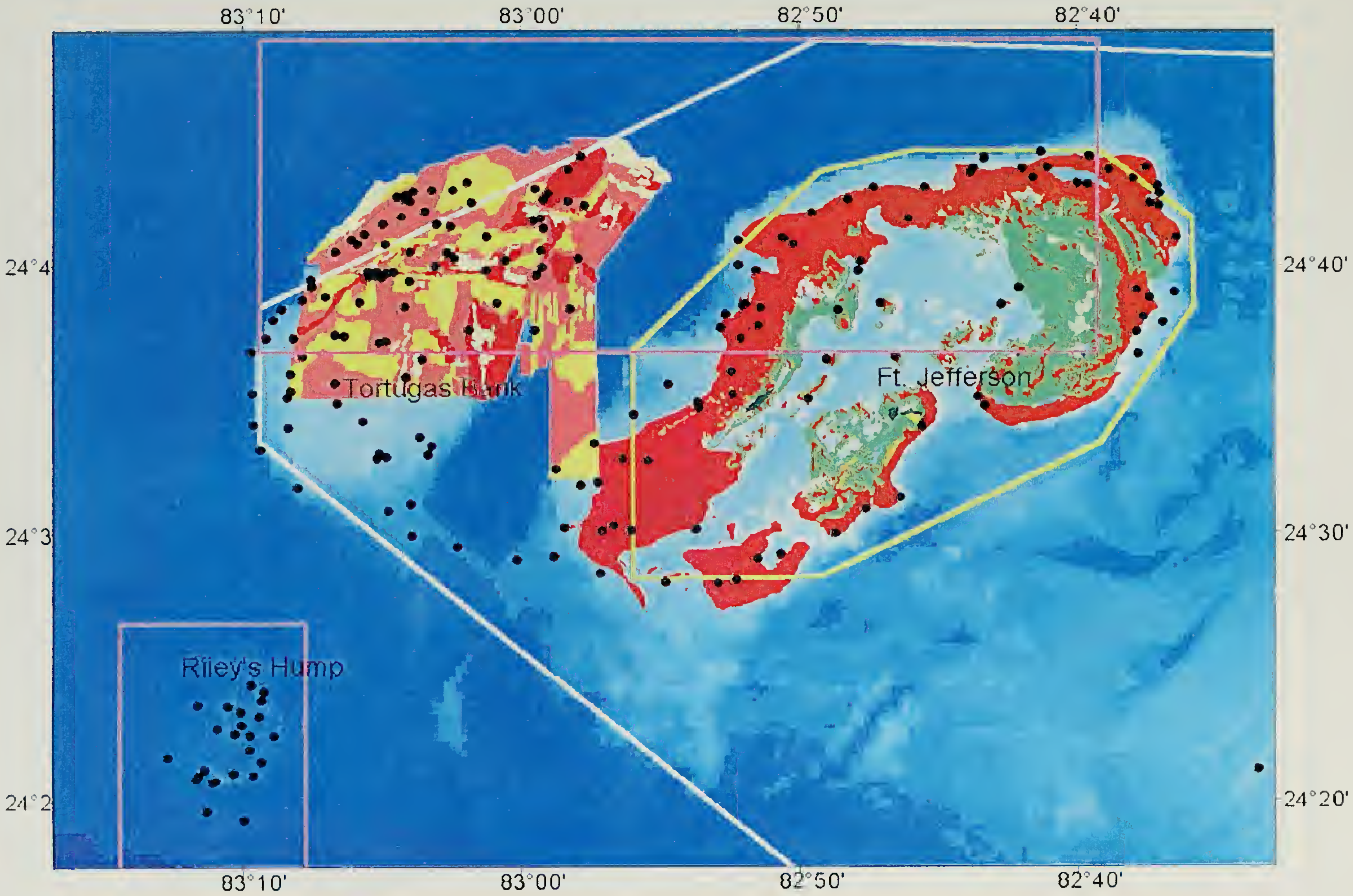


Figure B1: Spatial distribution of coral reef (red and pink), hardbottom (orange and yellow), and seagrass (green) habitats in the Dry Tortugas region interpreted from aerial photogrammetry and side-scan sonar (data sources: Florida Marine Research Institute and NOAA). Black dots indicate fish and habitat sampling sites from the 1999 NURC survey (Ault and Bohnsack 1999).

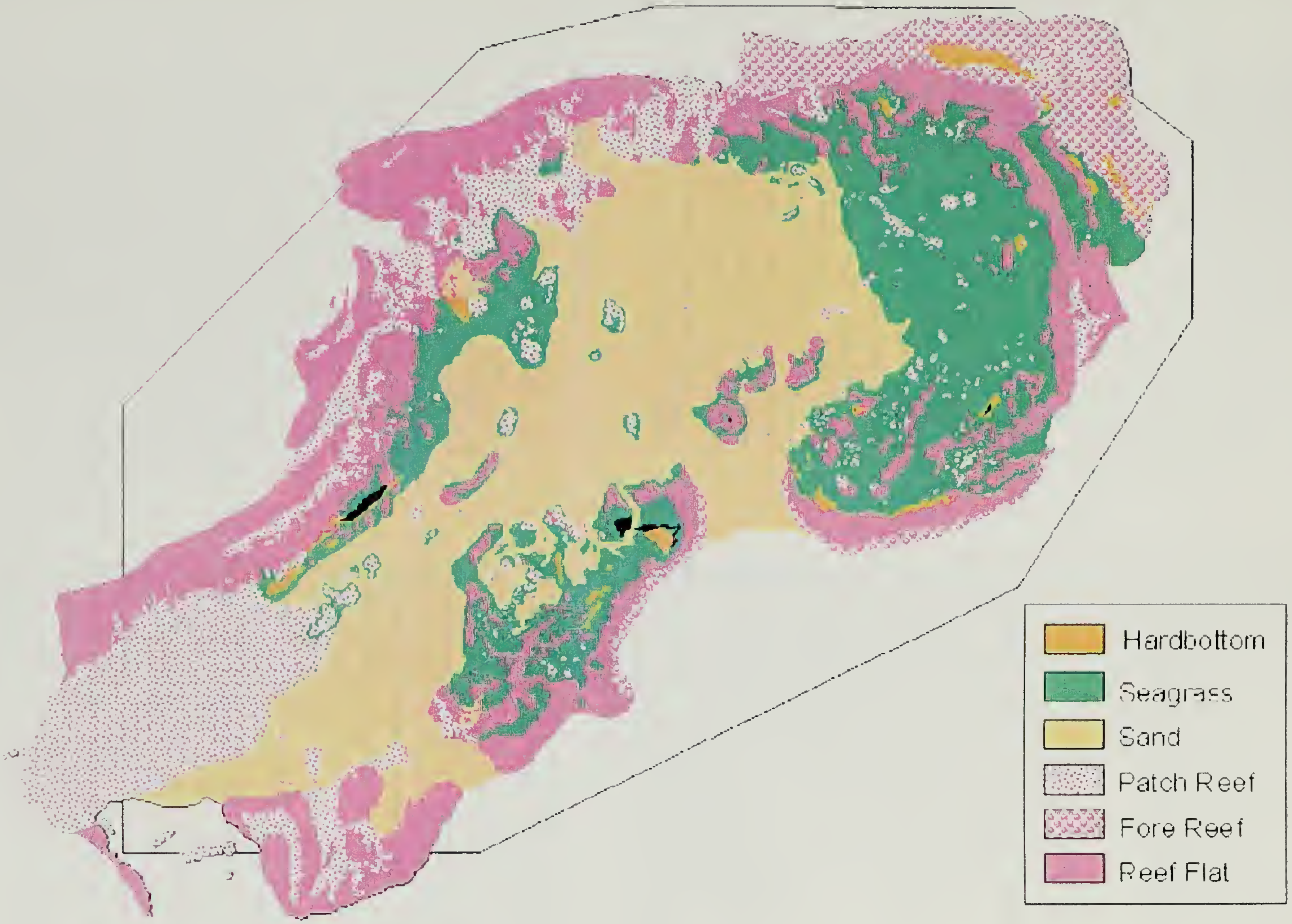


Figure B2: Distribution of benthic habitats within the park boundaries synthesized according to reef-type scheme developed by Meester (2000).

Deep reef areal extent was estimated based on bathymetry, shelf location, sampling, and expert opinion. Notably, the most pronounced differences in habitat distributions in the Tortugas region occur from east to northeast.

Terrestrial Habitats

The terrestrial environment of the park consists of seven islands that contain more than 200 species of plants and fauna; less than 50 of these species are native (NPS 1997a). The smaller keys, East, Bush, and Long, have mainly native plants due to limited visitation by large vessels and no permanent habitation by humans. Garden Key contains a large percentage of introduced plant species. All of the islands also contain beaches and associated intertidal habitats. These unique coral and sand island environments provide buffers to inclement seas and shallow-water habitats, and also provide critical shelter and vegetation resources for birds and turtles.

FISHERY RESOURCES

Dry Tortugas National Park fishery resources play important ecological and socioeconomic roles. The sheer number of different fishes (species) and fisheries (different kinds of fish communities and human-related fishing activities) in this region is extraordinary. More than 300 species of reef fish have been identified in the park (table A3) (Longley and Hildebrand 1941, Ault and Bohnsack 1999). The distribution and abundance of reef fish in coral reef environments is greater in the park than outside the park (Bohnsack et al. 1994). A number of important reef fishes and macroinvertebrates like groupers, snappers, spiny lobster, and pink shrimp have substantial regional economic and ecological value to the dynamics, productivity, and functioning of the broader Keys marine environment (Bohnsack et al. 1994). The productive marine environment of the Tortugas is also important to a host of other important bait, pelagic, and reef fishery resources (Meyer et al. 1983). Reef fishes can be used as sensitive indicators of environmental stress, because during their migrations from coastal bays as juveniles to the coral reefs as adults they encounter most natural and human-induced stresses found across the ecosystem.

The reef community can be divided into the following categories: (1) exploited (harvestable) reef fishes, such as snappers, groupers, and grunts; (2) exploited macroinvertebrates such as pink shrimp, spiny lobster, and queen conch; (3) unexploited prey including invertebrates, blennys, gobies, and the reef herbivore community such as butterflyfishes, damselfishes, surgeonfishes, and parrotfishes; (4) sharks and rays; (5) migrating pelagic fishes such as kingfish, Spanish mackerel, dolphinfish, billfishes, tuna, and tarpon; and (6) baitfish like anchovy, sardine, herring, killifishes, mojarras, and scads that support much of the large migrating fishes and large piscivorous (fish-eating) reef fishes.

A comprehensive quantitative study of reef fish resources and essential habitats in the park and surrounding region was conducted through a cooperative effort of the University of Miami, the National Marine Fisheries Service, the University of North Carolina at Wilmington, the Florida Keys National Marine Sanctuary, the National Park Service, and the National Oceanic and Atmospheric Administration from late May to mid-July 1999, covering an area of about 350 square miles with 450 sites and more than 1,150 unique reef fish visual survey scuba diver samples. The distribution of diver sampling sites from the survey is shown in the previous figure B1. This data was used to determine spatial density distributions of juvenile reef fish and the distribution of the average length of harvestable individuals in the exploitable phase of the stock (e.g., Ault et al. 1998, Ault and Bohnsack 1999).

Table A3: List of families (52) and species (238) of fishes observed in visual samples from the Florida Keys by NOAA and University of Miami divers, 1979–1998 (Bohnsack et al. 1999). About 200 of these species were observed in the 1999 visual census of the Dry Tortugas region.

Rhincodontidae
Ginglymostoma cirratum
Carcharhinidae
Carcharhinus limbatus
Sphyrnidae
Sphyrna lewini
Sphyrna mokarran
Dasyatidae
Dasyatis americana
Urolophidae
Urolophus jamaicensis
Mylobatidae
Aetobatus narinari
Mobulidae
Manta birostris
Elopidae
Megalops atlanticus
Muraenidae
Gymnothorax funebris
Gymnothorax milaris
Gymnothorax moringa
Gymnothorax saxicola
Gymnothorax vicinus
Clupeidae
Harengula jaguana
Jenkinsia lamprotaenia
Exocetidae
Hemiramphus brasiliensis
Belonidae
Tylosurus crocodilus
Atherinidae
Atherinomorus stipes
Hypoatherina harringtonensis
Holocentridae
Holocentrus adscensionis
Holocentrus coruscus
Holocentrus marianus
Holocentrus rufus
Holocentrus vexillarius
Myripristis jacobus
Ostichthys trachypoma
Gobiidae
Coryphopterus dicrus
Coryphopterus eidolon
Coryphopterus glaucofraenum
Coryphopterus personatus
Gnatholepis thompsoni
Gobiosoma evelynae
Gobiosoma macrodon
Gobiosoma oceanops
Gobiosoma randalli
Ioglossus calliurus
Ioglossus helenae
Microgobius carri
Microgobius microlepis
Callionymidae
Paradiplogrammus bairdi
Fistularidae
Fistularia tabacaria

Serranidae
Diplectrum formosum
Epinephelus adscensionis
Epinephelus cruentatus
Epinephelus fulvus
Epinephelus guttatus
Epinephelus inermis
Epinephelus itajara
Epinephelus morio
Epinephelus striatus
Hypoplectrus chlorurus
Hypoplectrus gemma
Hypoplectrus guttavarius
Hypoplectrus indigo
Hypoplectrus nigricans
Hypoplectrus puella
Hypoplectrus unicolor
Liopropoma eukrines
Mycteroperca bonaci
Mycteroperca interstitialis
Mycteroperca microlepis
Mycteroperca phenax
Mycteroperca tigris
Mycteroperca venenosa
Paranthias furcifer
Rypticus saponaceus
Serranus baldwini
Serranus tabacarius
Serranus tigrinus
Serranus tortugarum
Priacanthidae
Priacanthus arenatus
Priacanthus cruentatus
Apogonidae
Apogon binotatus
Apogon psuedomaculatus
Malacanthidae
Malacanthus plumieri
Echeneidae
Echeneis naucrates
Gerreidae
Eucinostomus argenteus
Gerres cinereus
Inermidae
Inermia vittata
Sciaenidae
Equetus acuminatus
Equetus lanceolatus
Equetus punctatus
Equetus umbrosus
Odontoscion dentex
Scombridae
Scomberomorus cavalla
Scomberomorus maculatus
Scomberomorus regalis
Aulostomidae
Aulostomus maculatus
Scorpaenidae
Scorpaena plumieri

Carangidae
Alectis ciliaris
Caranx bartholomaei
Caranx crysos
Caranx hippos
Caranx latus
Caranx ruber
Decapterus macarellus
Decapterus punctatus
Elagatis bipinnulata
Seriola dumerili
Seriola rivoliana
Trachinotus falcatus
Lutjanidae
Lutjanus analis
Lutjanus apodus
Lutjanus buccanella
Lutjanus cyanopterus
Lutjanus griseus
Lutjanus jocu
Lutjanus mahogoni
Lutjanus synagris
Ocyurus chrysurus
Pristipomoides aquilonaris
Rhomboplites aurorubens
Haemulidae
Anisotremus surinamensis
Anisotremus virginicus
Haemulon album
Haemulon aurolineatum
Haemulon carbonarium
Haemulon chrysargyreum
Haemulon flavolineatum
Haemulon macrostomium
Haemulon melanurum
Haemulon parra
Haemulon plumieri
Haemulon sciurus
Haemulon striatum
Sparidae
Archosargus probatocephalus
Archosargus rhomboidalis
Calamus bajonado
Calamus calamus
Calamus penna
Calamus proridens
Diplodus argenteus
Diplodus holbrooki
Lagodon rhomboides
Ostraciidae
Lactophrys bicaudalis
Lactophrys polygonia
Lactophrys quadricornis
Lactophrys trigonius
Lactophrys triqueter
Centropomidae
Centropomus undecimalis

Mullidae
Mulloidichthys martinicus
Pseudopeneus maculatus
Pempheridae
Pempheris schomburgki
Kyphosidae
Kyphosus sectatrix
Ephippidae
Chaetodiperus faber
Chaetodontidae
Chaetodon capistratus
Chaetodon ocellatus
Chaetodon sedentarius
Chaetodon striatus
Pomacanthidae
Centropye argi
Holacanthus bermudensis
Holocanthus ciliaris
Holocanthus tricolor
Pomacanthus arcuatus
Pomacanthus paru
Pomacentridae
Abudefduf saxatilis
Chromis cyanea
Chromis enchrysurus
Chromis insolata
Chromis scotti
Microspathodon chrysurus
Pomacentrus diencaeus
Pomacentrus fuscus
Pomacentrus leucostictus
Pomacentrus partitus
Pomacentrus planifrons
Pomacentrus variabilis
Cirrhitidae
Amblycirrhitus pinos
Sphyraenidae
Sphyraena barracuda
Sphyraena picudilla
Opistognathidae
Opistognathus aurifrons
Opistognathus whitehursti
Blenniidae
Hypleurochilus bermudensis
Ophioblennius atlanticus
Scartella cristata
Balistidae
Aluterus monoceros
Aluterus schoepfi
Aluterus scriptus
Balistes capriscus
Balistes vetula
Cantherhines macrocerus
Cantherhines pullus
Canthidermis sufflamen
Melichthys niger
Monacanthus hispidus
Monacanthus tuckeri

Labridae
Bodianus pulchellus
Bodianus rufus
Clepticus parrae
Doratonotus megalepis
Halichoeres bivittatus
Halichoeres cyanocephalus
Halichoeres garnoti
Halichoeres maculipinna
Halichoeres pictus
Halichoeres poeyi
Halichoeres radiatus
Hemipteronotus martinicensis
Hemipteronotus novacula
Hemipteronotus splendins
Lachnolaimus maximus
Thalassoma bifasciatum
Scaridae
Cryptotomus roseus
Nicholsina usta
Scarus coelestinus
Scarus coeruleus
Scarus croicensis
Scarus guacamaia
Scarus taeniopterus
Scarus vetula
Sparisoma atomarium
Sparisoma aurofrenatum
Sparisoma chrysopterum
Sparisoma rubripinne
Sparisoma viride
Clinnidae
Acanthemblemaria aspera
Acanthemblemaria chaplini
Emblemaria pandionis
Hemiemblemaria simulus
Labrisiomus nuchipinnus
Malacoctenus gilli
Malacoctenus macrops
Malacoctenus triangulatus
Malacoctenus versicolor
Paraclinus marmoratus
Paraclinus nigripinnis
Acanthuridae
Acanthurus bahianus
Acanthurus chirurgus
Acanthurus coeruleus
Bothidae
Bothus lunatus
Bothus ocellatus
Tetradontidae
Canthigaster rostrata
Chilomycterus antennatus
Chilomycterus schoepfi
Diodon holocanthus
Diodon hystrix
Sphoeroides splengleri

The data was also used to determine the spatial distribution of diversity, abundance, size, and distribution of the entire reef fish community and the snapper-grouper-grunt complex. A total of 194 reef fish species were seen throughout the Dry Tortugas region, with 141 of those seen in the park. The snapper-grouper-grunt complex is comprised of 35 species for the region, and 28 of those species reside in the park, including the endangered and/or protected Nassau grouper *(Epinephelus striatus)* and Jewfish *(Epinephelus itajara)*.

WILDLIFE RESOURCES

Rare, Threatened, or Endangered Animal Species

The Florida Fish and Wildlife Conservation Commission and the U.S. Fish and Wildlife Service were consulted regarding the presence of threatened, endangered, and special concern species that may occur in the park or are migrating species. According to the U.S. Fish and Wildlife Service, five species of sea turtles may be found in the waters of the park, and the loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles nest on park islands. In addition, the West Indian manatee (*Trichechus manatus*) and a number of bird species use the islands and waters within the park. The U.S. Fish and Wildlife Service reports there is no designated critical habitat within park boundaries. (See appendix H for complete list of species in Monroe County.)

Endangered, threatened, or special concern species listed by the Florida Fish and Wildlife Conservation Commission as potentially occurring in or adjacent to Dry Tortugas include one fish, seven amphibians and reptiles, 18 bird species, three mammals, and one invertebrate (see appendix H).

The park is also home to several species of fish protected by the National Marine Fisheries Service, including the Jewfish *(Epinephelus itajara)* and the Nassau grouper *(Epinephelus striatus)*.

Birds

About 300 migratory bird species occur in South Florida that the U.S. Fish and Wildlife Service is required to protect and conserve under authorities such as the Fish and Wildlife Coordination Act and the Migratory Bird Treaty Act. (See appendix H.) The seven small coral-sand islands at the park provide critical nesting and feeding habitats for substantial numbers of sea birds, including the white-tailed tropicbird *(Phaethon lepturus)*, magnificent frigate bird *(Fregata magnificens)*, masked bobby *(Sula dactylatra)*, red-footed booby *(Sula leucogaster)*, brown pelican *(Pelecanus occidentalis)*, laughing gull *(Larua articilla)*, royal tern *(Sterna maxima)*, sandwich tern *(Sterna sandvicensis)*, roseate tern *(Sterna dougallii)*, sooty tern *(Sterna fuscata)*, least tern *(Sterna antillarum)*, brown noddy *(Anous stolidus)*, and black noddy *(Anous minutus)* (NPS 1994). The park affords unique opportunities for seeing tropical seabirds, including the only significant nesting colonies in the United States for sooty and noddy terns and harbors the only frigate bird nesting colonies in the continental United States.

Sea Turtles

The park area includes the most isolated and least disturbed nesting habitat for several endangered and threatened sea turtles in the United States. Loggerhead turtles *(Caretta caretta)* are the most abundant species to nest in the Dry Tortugas and have the largest population size of any sea turtles in the United States (NPS 1998). The earliest accounts of green turtle *(Chelonia mydas)* nesting in Florida are from the Dry Tortugas (Audubon 1926; Gifford 1934). Turtles were so abundant that between 1858 and 1859 more than 39,588 pounds of turtle meat was consumed by soldiers stationed at Fort

Jefferson. More current information reveals that the park is one of the most significant Florida green turtle nesting colonies in the Caribbean (Meylan et al. 1995). During recent years of monitoring throughout the nesting season, a total of 1,652 turtle crawls produced 728 nests and an estimated 58,958 eggs (NPS 1998). Available evidence suggests that this population differs genetically from other significant Caribbean populations (Allard et al. 1994). Three other species of turtles are known from Florida Keys waters that might be found in or near park waters on occasion.

Marine Mammals

Nineteen species of marine mammals are known from South Florida waters, and 10 additional species may occur there, based on strandings and sightings in nearby waters (NPS 1998). Only two of the 19 species are known to occur in the park from live, nonstranded sightings — the bottlenose dolphin and the Florida manatee; another three species have been found stranded within the park or in nearby waters — (Fraser's dolphin, short-finned pilot whale, and false killer whale (NPS 1998). The remaining species may occur or pass through park waters from time to time.

ENVIRONMENTAL SETTING

Soundscape/Night Lighting

The Dry Tortugas National Park provides a very unique and rare natural setting due to its remote location and remarkable environmental makeup. The remote location of the park provides an ambience of extreme quiet and natural soundscapes, including a backdrop of migrating birds and the ocean. The distance from civilization also provides a rare opportunity for people to experience the night sky without the interference of city lights that dramatically inhibit the view of the stars.

Wetlands

Wetlands are identified on the U.S. Fish and Wildlife Service's *National Wetland Inventory* 7.5-minute quadrangle map for the Dry Tortugas area. The map classifies areas around the islands in the park and large areas south of the fort and west of Loggerhead Key primarily as marine subtidal and intertidal wetlands. The marine system consists of the open ocean overlying the continental shelf and its associated coastline. Marine habitats are exposed to the waves and currents of the open ocean, and the ebb and flow of oceanic tides is the primary determinant of whether the area is subtidal (continuously submerged) or intertidal (exposed and flooded by tides). Large areas of wetlands in the park are in the aquatic bed class and rooted vascular subclass, also called sea grass beds, among other terms. Wetlands occurring primarily immediately around the islands are in the unconsolidated shore class and the irregularly exposed or regularly flooded subclasses.

Small areas of estuarine subtidal and intertidal wetlands occur in the northwestern portion of Garden Key and near Bush, Long and East Keys. The estuarine system consists of deepwater tidal habitats and adjacent tidal wetlands that are usually partially enclosed by land and have partly obstructed or sporadic access to the open ocean. The ocean water is at least occasionally diluted by freshwater runoff from the land. (Cowardin et al 1979)

Water Quality

The lack of major sewage and runoff areas, along with the dynamic ocean currents running through the park, provide fairly pollution-free waters for natural resources and human enjoyment. Results of a long-term monitoring project conducted by Florida International University (Boyer and Jones, 2000) provide trends in water quality over the last decade in the western part of

Florida Bay, an area that directly influences the water quality around the park. During the period of observation, the salinity declined by 5.6 ppt (parts/thousand), most likely due to increased average rainfall. Turbidity has increased by a factor of 4 due most likely to the loss of sea grass coverage and its stabilizing influence on the bottom and sediments. Although there was a significant increase in chlorophyll *a* concentrations in the western part of the bay, these levels are still modest by estuarine standards.

RESOURCE MONITORING

Dry Tortugas National Park was established in 1992 "to preserve and protect nationally significant natural, historic, scenic, marine, and scientific values in South Florida." To assess if current management activities are fulfilling this congressional mandate, a number of scientific projects systematically monitor the natural and cultural resources of the park. In addition to Florida International University's long-term monitoring project for water quality mentioned above, as part of the Florida Keys National Marine Sanctuary's and the Environmental Protection Agency's water quality protection program, Florida International University's Southeast Environmental Research Center monitors various water quality parameters inside the park on a quarterly basis. Likewise, the university also monitors sea grass presence and density at a number of stations inside the park. These projects have been ongoing since 1996.

The Americorps Program, Florida International University, and now the University of Florida's Center for Sea Turtle Research have monitored the status and trends of nesting sea turtles since 1995. Data collected include the number and location of successful nests as well as histological analysis of randomly selected hatchlings. The Florida Marine Research Institute (FMRI) has monitored six long-term (1989–present) coral habitat stations on an annual basis, documenting coral diversity and percent cover. The sanctuary's coral reef monitoring program set up four permanent coral sampling locations inside park waters in 1999. During the last three years, FMRI scientists have also noted the abundance, size, and fecundity of spiny lobsters *(Panulirus argus)* inside park waters (Bertleson and Hunt 1997).

Scientists at the University of Miami's Rosenstiel School, the National Marine Fisheries Service, and the University of North Carolina at Wilmington have been conducting spatially intensive assessments of the Tortugas multispecies coral reef fish populations and habitats inside the park since 1994. On at least an annual basis, collaborating scientists using scuba gear visually survey all reef fish populations, assessing and quantifying the spatial distribution of diversity, abundance, numbers and sizes (biomass), exploitation levels, surplus yields of the multispecies coral reef fish community, and reef fish habitat preferences. In a substantially more limited effort, volunteers from The Reef Environmental Educational Foundation also list species and give rough counts of coral reef fishes at sites within the park on an annual basis as part of their roving diver field technique.

Because of the park's remoteness (about 70 miles or 118 kilometers west of Key West), monitoring projects are very expensive to fund, require collaborative efforts, and rarely involve more than annual or semiannual sampling. Because of the park's extreme importance as a regional reference site, sampling has taken place after any extreme or unusual events have occurred. Examples of these include the passage of Hurricane George, strong thermal stresses such as pronounced upwelling events, or coral bleaching and disease outbreaks.

PREHISTORIC ARCHEOLOGY

There are no recorded prehistoric sites in the Dry Tortugas, and aboriginal occupation or use of the islands is not well documented in historical records. The scarcity of readily available fresh water would likely have been a limiting factor, impeding extensive or long-term habitation. The possibility, however, that prehistoric or early historic period activity did occur may be borne out through further ethnographic research and controlled surveys. Previous ground disturbance, from both human activities (e.g., the construction of Fort Jefferson) or natural events (such as wave erosion and storms) have likely obliterated or obscured land-based prehistoric remains that may have existed.

Despite the lack of surface discoveries, many archeologists consider it reasonable for submerged prehistoric artifacts and sites to be present in the area (Cockrell 1993, pp. 63-95). Paleo-Indian hunters and gatherers, for example, are known to have been in south Florida approximately 10,000 to 12,000 years before the present (B. P.). Sea levels at the beginning of that period were considerably lower (by 60 to 100 meters), and the region encompassing the Tortugas was then connected to the mainland peninsula by dry limestone uplands of the Florida continental shelf. Access to the Tortugas would therefore have been possible for these early nomadic people.

By the beginning of the Archaic cultural period (ca. 8,500 B. P.) seawaters had risen to within 25 meters of the current coastline. Archaic period people took advantage of the increased biological diversity that accompanied the period's warmer and wetter climate. They relied on an abundance of shellfish and other coastal resources, and supplemented fishing with intensive hunting and plant gathering. Populations increased significantly, and village communities were in existence by 7,000 B.P. in south Florida. They also used watercraft, and therefore had the means to travel between regional islands and mainland areas for cultural exchange and subsistence purposes.

Submerged areas in the Tortugas that were once accessible to prehistoric people are in many instances buried under several meters of coral reef, rubble, and accumulated sediments. Under favorable circumstances, cultural remains from these early inhabitants may have been preserved, and evidence might be uncovered by future archeological investigations. Consideration of submerged prehistoric resources should be addressed by project undertakings having the potential to disturb deep sediment layers.

SHIPWRECKS

The Dry Tortugas have served as important navigational points since 1513 when Spanish explorer Ponce de León's discovery of the islands brought them to the attention of European seafaring nations. Located at the maritime crossroads linking the Gulf of Mexico, the western Caribbean, and the Atlantic Ocean, the Tortugas' treacherous shallow reefs have claimed numerous ships navigating the 75-mile-wide Straits of Florida. More than 275 maritime casualties (ships that are totally lost, stranded, or impaired), have been historically documented within the 100 square miles of park waters. This represents one of the largest assemblages of shipwreck sites in North America.

These sites provide a rich archeological record spanning more than four centuries of international economic and political activity in the region. One vessel thought to be of Spanish origin and dating to 1622 is among the earliest recorded sites in the park. It is also likely that earlier undiscovered wrecks are present in park waters; before 1600, Spanish fleets returning to Spain from Vera Cruz followed a route that brought them close to the Tortugas as they hugged the shore around the Gulf of Mexico. Following the era of European exploration and early colonial activity, historical records document repeated maritime casualties continuing to recent times. Sites such as the "East Key Construction Wreck" and the "Bird Key Harbor Brick Wreck" represent 19th century vessels that were en route to Fort Jefferson to deliver bricks and other building materials.

To date, 36 separate sites have been listed in the archeological database for the park. Of these, about one third have received thorough archeological documentation. Multiple ship casualties occurring in the same location at different times sometimes complicate the archeological record. Material remains associated with these sites commonly include anchors, rock and iron ballast, cannon or gun tubes, iron chain, fasteners, hardware, ceramics, brick, etc. The Windjammer off Loggerhead Key, with a portion of its iron hull exposed above water, is one of the few sites for which historical documentation has been correlated to confirm its identity. Constructed in Scotland in 1875 and originally named the *Killean*, the ship was under Norwegian ownership and renamed the *Avanti* at the time it went down in 1907. Ongoing research may provide more accurate historical correlation for other identified shipwreck sites.

NPS archeologists have compiled site information into a database that allows comparative analysis of the frequency of reported ship casualties, weather or storm factors, the influence of supply and demand on the seasonal timing and types of cargo transported, home ports, and other variables. The database has facilitated analysis of wreck sites as an interrelated collection having associated research values. Approached from this broader regional perspective, research may provide clearer insight into maritime historical processes and patterns of activity. These processes ultimately reflect world economic and political systems. One objective of the park's "Submerged Cultural Resource Strategy" (described in alternatives B–E) is the preparation of a multiple-property National Register of Historic Places nomination that would document the significance of recorded shipwreck sites within this broad historic context.

Shipwrecks are attractive places for divers to explore because of the sense of discovery and curiosity they evoke. They also serve as suitable locations for the establishment of coral and other marine growth, providing habitat for a wide variety of fish and other aquatic species. The park is seeking to expand opportunities for visitors to experience selected sites and to receive interpretive information regarding their importance. Currently, the Windjammer and Bird Key Harbor Brick Wreck sites are the only ones that the park encourages divers to visit; they are stabilized, well documented, and have no associated artifacts that could easily be removed by visitors.

Other sites that could be opened to public interpretation would have to be approved on the basis of at least the following criteria: the site would need to: (1) have documented historical and cultural significance that would further the park's educational and interpretive objectives; (2) be clearly recognizable as a wreck site by its appearance/configuration; (3) be stabilized and "hardened" (archeological values could not be compromised by artifact removal or other destructive activities); (4) serve multiple visitor use purposes (underwater photography, snorkeling, etc.); (5) have wide public accessibility under optimal conditions of visitor safety; and (6) be feasible for the park to effectively manage through the maintenance of mooring buoys, patrols, etc. A monitoring program would be put in place before any site would be opened to public visitation to assess possible visitor use impacts. Archeologically sensitive sites would remain off limits to the public.

FORT JEFFERSON

Fort Jefferson stands as an enduring monument to the strategic importance of the Dry Tortugas to American coastal defenses during the 19th century. Occupying about 16 acres on Garden Key, the fort was constructed as part of the federal program of integrated coastal defenses known as the Third System. The program, to bolster and upgrade perceived deficiencies among the nation's earlier fortification systems, was enacted in 1817 and placed under the direction of American military engineers. The construction of Fort Jefferson began in 1846, largely in response to unsettled international affairs affecting the region. Spain's diminished role in the Western Hemisphere had left a power vacuum, and British fortification of Bermuda alarmed U.S. officials. Likewise, the escalating conflict with Mexico posed serious concerns for Gulf commerce and other regional American interests. The United States considered a strong and permanent military presence in the area crucial for protecting Gulf trade and ports. It would also preempt use of the Tortugas' anchorages by hostile enemy fleets should attempts be made to blockade the United States.

The brick masonry fort was designed as a hexagonal structure intended for an armament of about 450 guns and a garrison of 1,500 men. Only about 140 guns were ever actually mounted. The fort's irregular shape (four of the faces are 476 feet long and two are 325 feet long) was a result of adapting it to the shape of Garden Key. Six bastions were constructed at the angles of the two-tier 50-foot-high scarp walls. The perimeter of the fort is nearly 0.5 mile in length, surrounded on all sides by a moat and outer counterscarp or seawall. The interior fort walls were constructed of more than 2,000 brick arches and vaults, partitioned into casemates that the park in some instances has converted to staff/administrative use quarters. Cisterns for the collection of rainwater were constructed below each lower tier casemate; subsequent settling of the fort cracked many of the cistern walls, making them unusable as seawater leaked in. The interior parade area is accessed by means of the single sally port with a granite entrance arch. A nonhistoric bridge spans the moat to the sally port. Within the parade grounds are the foundation remains of former soldier's barracks and officer's quarters. Two historic engineer officers' quarters remain, which have been used for park housing. There are also two partially completed brick magazines and a shot furnace (a furnace that was used to superheat cannonballs for the purpose of inflicting further damage on targeted enemy ships by setting them ablaze).

The construction of Fort Jefferson proceeded slowly because of its immense size, the large expense entailed, and technical/logistical problems. The fort remained under Union control throughout the Civil War, and construction continued during and following the war. The fort functioned as a prison for about 800 Union army deserters and other offenders. Four of those convicted of conspiracy in President Lincoln's assassination were incarcerated there, including Dr. Samuel Mudd who had set John Wilkes Booth's broken leg. Yellow fever epidemics, small pox, and other diseases claimed many of the fort's population.

The fort's garrison departed in 1874, and construction activities were suspended in 1875, before the fort's full completion. None of the casemates were completed along the upper tier of the ramparts. Many of the embrasures (gun openings through the walls) were also never finished, remaining today as large irregular openings. In 1876 a hexagonal-shaped lighthouse was constructed of boilerplate iron atop bastion 6 to replace the original light, which was built in 1825 on Garden Key. The earlier light had sustained extensive hurricane damage in 1873.

The fort served as a coaling station during the Spanish-American War. The battleship *Maine,* which had refueled at the Tortugas, exploded in Havana Harbor in February 1898, propelling the United States to war with Spain. The ruins of two coaling docks built by the Navy at the turn of the century are at the north and south ends of Garden Key. Abandoned by the military after 1906, the Tortugas were declared a wildlife refuge in 1908 to protect sooty tern nesting areas from egg collectors. Fort Jefferson, however, continued to serve military purposes during subsequent conflicts — as a communications station and seaplane base during World War I, as a naval support station during World War II, and as a military outpost during the Cuban missile crisis of 1962. Fort Jefferson National Monument was established in 1935, and the fort property was listed on the National Register of Historic Places in 1970.

Fort Jefferson's masonry has severely deteriorated because of the harsh marine environment. In some areas large sections of the outer brick wall have crumbled into the moat. Stabilization projects are underway to preserve the masonry where feasible. One of these projects is to replace original gun shutters that were designed to close after artillery was fired to provide protection from incoming enemy fire. These shutters were made of iron, and they have expanded during the process of corrosion, displacing the surrounding masonry. Repairs have also recently been made to the sally port and its granite arch. Restoration of the parade magazine and shot furnace are additional preservation objectives.

Archeological investigations of land-based areas within and outside the fort have not been extensive, although some features, such as the foundations of the Garden Key lighthouse and lighthouse keepers quarters, have been identified. The probability for subsurface features and artifacts remains high, including those potentially within the moat.

LOGGERHEAD KEY

The Loggerhead Key lighthouse is the most prominent historic structure on this key, which is about 2.5 miles west of Fort Jefferson. The 150-foot-high brick tower was completed in 1858 to provide improved warning of the Tortugas' dangerous reefs. The smaller 70-foot-high Garden Key light was then considered inadequate. The spiral stairway within the Loggerhead Key lighthouse has 180 cut slate steps that lead to the watch room and lantern gallery. The tower was seriously damaged by a hurricane in 1873. Although Congress appropriated $75,000 in 1875 for complete replacement of the lighthouse, temporary masonry repairs were undertaken that proved so effective that replacement plans were canceled.

The first light was a 1st order Fresnel lens imported from France that could be seen from 20 miles on a clear night. It was replaced in 1909 by a revolving 2nd order bivalve lens that floated in a mercury pool. This light (reportedly observed at a distance of more than 53 miles in 1934) was removed in 1986 and is now on display at the United States Coast Guard Aids to Navigation School in Yorktown, Virginia. The current light is an electric generator-powered rotating beacon. The automated system has eliminated the need for a permanent on-site lighthouse keeper.

The original lighthouse keeper's house (built in 1856–58) was a two-story brick building with a detached kitchen. The house burned down in 1945 (its foundation exists), but the kitchen survived and was later converted to guest quarters. Other existing significant buildings and structures include the original two-story brick oil storage building (built in 1856–58 and converted to a radio room in 1926); the bosun's workshop (built in 1926 to house oil for the lighthouse following conversion of the original oil storage building); crew's quarters (a one-story brick bungalow built in 1922 to provide modernized accommodations for the principal lighthouse keeper and his family); a boat house built around 1923; and cisterns (two built of brick in 1858, and two built of concrete in 1922).

Ruins of the Carnegie Institution of Washington, D.C., marine biology laboratory are on the north end of the key. The laboratory operated from about 1904 to 1939, when a disastrous fire destroyed the facilities. Researchers made notable contributions to scientific understanding of coral reefs and tropical marine life in the Western Hemisphere. The first underwater photographs (both black and white and color) were taken of nearby reefs by lab technicians. A metal plaque at the lab site commemorates the lab's founder and first director, Alfred G. Mayor. Preliminary NPS archeological investigations conducted in 1998 indicate that the site may yield significant archeological information associated with research operations.
The 1998 NPS archeological investigations also identified a significant site associated with the development and operations of the original lighthouse complex. Trash dumps and artifacts dating to the 1856–58 construction period and after were found that may further understanding of the station's construction and the lifeways of the residents. Another site, the grave of U.S. Navy seaman Thomas Lehay, who died in 1898, is near a coral rock wall along the east side of the island. The grave is not considered a site that contributes to Loggerhead Key's overall historical significance.

A National Register of Historic Places nomination has been prepared for the Loggerhead Key Historic District (draft, NPS 1999b). The entire land area of Loggerhead Key is included in the historic district, although primary historical significance is attached to the areas of the lighthouse station complex and the Carnegie marine laboratory.

Visitors travel to Dry Tortugas by commercial or private boat or by seaplane. Two ferry vessels each bring up to 100 passengers from Key West to Garden Key daily. Travel time is about 2½ hours each way, and visitors spend about 4 hours on Garden Key. The ferry operators provide an in-transit orientation to the park along with a video describing park resources. They also conduct an interpretive tour of the fort and provide lunch for their passengers at the picnic area. Seaplanes carrying from five to nine passengers make trips daily from Key West. Flying time is about 35 minutes each way.

Recreational opportunities available to visitors include swimming, snorkeling, fishing from the dock, beach combing, bird and wildlife watching, photography, camping, kayaking, picnicking, and scuba diving to see coral, fish, and shipwrecks.

Visitors to the park currently receive information about the park in various ways. The park website and park headquarters at Everglades National Park provide basic information about the history, natural and cultural resources, recreational and educational opportunities, and how to obtain transportation to the park. If a person decides to travel to the park with one of the ferry operators, they receive an interpretive talk that expands on the same categories of information. Any visitor who arrives at Garden Key may take a tour of the fort guided by an NPS interpreter or by an employee of a ferry boat operator. A self-guiding tour permits visitors to follow an interpretive trail around the fort independently. Because of the small staff, ranger-led tours and special interpretive programs are limited.

Although commercial fishing is prohibited in the park, recreational saltwater fishing is allowed if visitors have a Florida fishing license. Charter fishing boats carrying up to six people are allowed if they have been granted permits by the National Park Service. Jet skis are prohibited.

There is no food service or freshwater showers for visitors on the islands; the only two freshwater drinking fountains are at the visitor center and outside the office. Visitors must bring their own supplies and must carry all trash with them when they leave the park.

A1995 visitor survey identified the most common activities in Dry Tortugas as follows: visiting Fort Jefferson (98%), taking photographs (87%), and snorkeling (83%). Seventy-eight percent of visitors surveyed did not engage in fishing, but 46% of those who did fish rated their fishing experience a very important or extremely important part of their visit. The areas visitors most often fished were around the fort and near Loggerhead Key. The most common reasons for visiting the park were outdoor recreation pursuits (41%) and to learn the history of Fort Jefferson (31%). Thirty-two percent of the survey's respondents visited Loggerhead Key. The primary activities they participated in were snorkeling and diving (77%) and walking on the beach (71%).

Sixty-three percent of the visitors were Florida residents. The next largest groups were from Texas and California, with 4% each. For 90% of the visitors their trip during the survey period was their first in a year, and for 71% it was their first trip to the park in five years.

During the past six years, visitation to the park has increased from a low of 16,736 recreational visits in 1994 to more than 84,000 recreational visits in 1999. About 5,244 visitors camped overnight. In 1999 about half of the park's visitors arrived by ferry, nearly 25% traveled by private boats, about 10% came by seaplane, and about 10% were commercial boats (fishing). The remainder (5%) were NPS staff and/or researchers. Conditions at the dock, campground, and restrooms become quite crowded during peak visitation periods because the number of staff and the capacity of utilities and facilities have not kept pace with the increase in visitors. In 1999 peak visitation occurred from April to July, and more than 8,000 visitors arrived each month. With the park's proximity to Cuba, the potential exists for a much greater increase in visitation in the future if political conditions in that country give residents freedom to travel.

The Florida Keys are composed of 1,700 keys or islands, all of which are in Monroe County. Dry Tortugas National Park is the westernmost part of the Florida Keys and is about 70 miles west of Key West, Florida. The park contains seven of these keys and is administered by the National Park Service. Fewer than 70 of the 1,700 keys are inhabited, and 51 of the easternmost keys are connected to or by U.S. Highway 1. Most of Monroe County's landmass is on the mainland of Florida, and most of the population is in the keys, particularly in population centers such as Key West, the county seat.

The socioeconomic environment description will focus on Monroe County but will be discussed in the larger context of the South Florida Regional Planning Council region, which includes Dade and Broward Counties (State of Florida 1994 and South Florida Regional Planning Council 1995). These counties are closely linked in terms of tourism and tourist-based economies.

POPULATION AND INCOME

Possibly the most important factor influencing the South Florida region is its explosive growth. In 1970 there were nearly 2 million people living in the region; there were 3.4 million in 1994 and nearly 3.7 million in 1997. According to the *Strategic Regional Policy Plan for South Florida* (South Florida Regional Planning Council 1995), the population is expected to increase to about 4.3million residents by the year 2015. This influx most likely will be led by international migration. The region has less than 8% of the state's land area but almost 25% of the state's total population.

Population growth has been lower in Monroe County than the rest of the region and the state because of the limited availability of land and an ordinance that was designed to limit future growth. The county's permanent resident population in 1997 was 81,169. The population fluctuates seasonally and increases dramatically during peak tourism periods. Dade County was the most populous in the region and state with 2,128,987 permanent residents, and Broward County had 1,472,927. Since the 1950s, south Florida has rapidly become urbanized. Dade and Broward counties were 99% urbanized by 1980, whereas 27% of Monroe County's population still lived outside urban areas in 1990.

About 17% (544,000) of the region's residents were at least 65 years old compared to the national average of 13%. Half of this population was at least 75 years old. Projections indicate that there will be more than 700,000 people 65 years old or older in 2015.

In both Monroe and Broward Counties, per capita personal income in 1997 — $29,657 and $27,661, respectively — was higher than the state average of $24,799. Dade County was below the state average with $21,688. In 1999 (January – November), unemployment rates in Monroe County ranged from 1.9% to 3.0%. The Ft. Lauderdale MSA (metropolitan statistical area) rates for the same period ranged from 3.9% to 4.9% and were similar to the state's range of 3.9% to 4.6%. The Miami metropolitan statistical area reported the region's highest unemployment rates with ranges from 5.7% to 7.1%.

TOURISM AND RECREATION

More than 10 million tourists annually are attracted to the region by the area's climate and resources including the Everglades and southern Florida's coastal resources. The number of tourists to the area results in a direct economic benefit of more than $13 billion for the region. Fifty-one percent of

South Florida's visitors are from the northeast part of the United States, 23% are from the north central region, 22% are from the south central region, and 6% are from the West Coast. The number of international visitors to Dade County increased to 4 million in 1994, up from 2.9 million in 1989. Foreign visitors to Broward County tripled to 1 million from 1989 to 1991.

More than 4 million people visit the Florida Keys every year. Peak tourist season is from January to March, and in the Upper Keys the tourist season is from January to August. Many tourists in the Upper Keys are weekend visitors from Miami and south Florida. Visitors to the Keys comprise 42% of the total population during the peak season.

According to Florida's 1994 statewide comprehensive *Outdoor Recreation Plan*, in 1992 the South Florida Region had nearly 2.7 million acres of land and water available for outdoor recreation from both public and private sources. The region provided about 72 miles of saltwater beach frontage, 1,907 miles of bicycle trails, 180 miles of nature trails, and 12,145 developed campsites. There were 341 saltwater and 196 freshwater boat ramp lanes and 376 saltwater marinas.

Federally administered lands comprised nearly 1.8 million acres of land and water that was available for outdoor recreation; about 70% of this acreage was in Everglades National Park in Monroe and Dade Counties. State-administered recreation land comprised 850,000 acres in 78 sites, including John Pennekamp Coral Reef State Park and Key Largo Coral Reef and Looe Key National Marine Sanctuaries. County and municipal governments also provided facilities for urban recreation activities. Local governments provided 191 saltwater beach areas and 97% of the region's freshwater beach area. Forty-three percent of demand for outdoor recreation in 1992 came from residents of the South Florida Region.

The most popular outdoor recreational activities in 1992 included saltwater beach activities, swimming pool use, bicycling, saltwater fishing (boat), golf, picnicking, and visiting archaeological/historic sites. Other recreation opportunities include boating, hunting, camping, and nature study.

In the Keys most recreation activities are related to water. According to the *Florida Keys National Marine Sanctuary Final Management Plan/Environmental Impact Statement* (1996), boating activities account for about 13% of all visitor use. About 55% of all visiting boaters participate in fishing activities, and 29% of all tourist boating activities include scuba diving and snorkeling trips. About 20% to 30% of all visitors to the Keys snorkel or scuba dive to see fish, coral reefs, and shipwrecks. The Upper Keys contains almost 90% of the popular dive sites, including Key Largo National Marine Sanctuary and John Pennekamp Coral Reef State Park.

Fishing-for-hire activities are important to the Keys' tourist industry, with reef fishing concentrated in the Middle and Lower Keys; the largest number of reef fishing boats is in Key West. However, fishing from one's own boat is the principal way of fishing in the Keys. The number of privately owned vessels has multiplied more than six times since 1965, and more than 106,000 boats were registered in Monroe, Broward, and Dade Counties in the mid-1990s. A survey of private boat fishermen in 1980–81 determined that 43% were from Dade and Broward Counties, 31% were from the Keys, 13% were from other areas of Florida, and 13% were from areas outside Florida.

ECONOMY

Tourism-related jobs rank in the top sectors of the regional economy in terms of employment, particularly lodging and eating and drinking establishments. As a result, the regional economy has become more service oriented and less oriented towards goods-producing industries. In 1997 in Monroe, Broward, and Dade Counties, the services industries produced the largest earnings, with 35.6%, 34.1%, and 33.8% of total earnings, respectively. Retail trade accounted for the second largest earnings in Monroe (19.0%) and Broward (12.9%) Counties, while state and local government was second (11.5%) in Dade County. Earnings in state and local government were third largest in Monroe County (11.9%) and Broward County (11.6%), and the transportation and public utilities sector produced the third-largest earnings in Dade County (10.3%.)

The basis of Monroe County's economy essentially is tourism and tourist-related service industries. Nearly 75% of new jobs created in Monroe County during the past decade were in the service and retail trade sectors. These two industries make up 52% of the total employment in the county. The service sector includes the hotel and restaurant trades, and the retail trade sector includes gift shops, apparel stores, and businesses that provide products such as fishing and boating equipment and photography supplies.

Employment levels are seasonal and are at their highest during the peak tourist season, December through April, decline from May through October, and begin increasing in November.

Retired people plus tourists account for the most income in Monroe County. The county has a large retirement population in which 29% of the residents are at least 55 years old and 16% are at least 65 years old. About 48% of all income is from nonwage sources, such as social security, retirement pensions, and interest income. When both retirement and tourist income flow into the area and are independent of employment, there is a demand for local goods and services and employment and additional income is created.

A visitor use survey to determine how much tourist recreation activities contribute to the Monroe County economy estimated that visitors spent $1.19 billion in the Keys during the periods of June through November 1995 and December 1995 through May 1996. Businesses that receive tourist dollars directly have a ripple effect on other businesses that sell supplies to them and on down the supply chain. This ripple effect can benefit the economy with 1.5 to 2 times more than the amount visitors originally spent. The total output, or value for all goods and services produced by an industry sector in the Keys economy during the periods mentioned above, was $2.20 billion. For the survey period the ripple effect of tourist spending resulted in an estimated contribution of 60.53% of total output, 45.03% of the total estimated income, and an estimated 46.49% of total employment in Monroe County.

Economic impacts from tourism in Monroe County extend to other counties in the region. Visitors to the Keys purchase items on the way, and many businesses in the county are supplied by businesses in Broward or Dade Counties. During the survey period, visitors to the Keys contributed about $1.61 billion in output, $1.37 billion in income, and about 8,300 full-time equivalent jobs to the two counties.

Table 8 shows responses to a mailback questionnaire used in the above visitor use survey to estimate spending per person per trip. The table reflects types of expenditures, total amount spent on the trip, location of expenditures, and percentages spent in the locations of Monroe County only or in the south Florida region, which included Dade, Broward and Monroe Counties. The figures included not only expenditures related to the specific trip but also annual expenses for boat storage rental space and marina fees, condo/time-share fees, and annual RV site rentals in Monroe County. Annual expenses were divided by the number of people per group and number of trips made annually to the Keys.

TABLE 8: AVERAGE TRIP EXPENDITURES PER PERSON

Type of Expenditure	Total Expenditures for Trip	Amount Spent in S. Florida	% Spent in S. Florida	Amount Spent in Monroe County	% Spent in Monroe County
June – November 1995					
Lodging	$256.73	$195.06	76.0%	$150.4	58.6%
Food and Beverages	166.58	141.99	85.2%	112.0	67.2%
Transportation	238.66	98.25	41.2%	39.53	16.6%
Boating	78.38	76.75	97.9%	28.32	36.1%
Fishing	11.21	10.75	95.9%	10.14	90.5%
Scuba Diving/Snorkeling	19.75	19.08	96.6%	18.51	93.7%
Sightseeing	22.52	14.74	65.5%	9.84	43.7%
Other Activity Expenditures	9.58	7.47	78.0%	5.36	55.9%
Miscellaneous	66.58	48.69	73.1%	33.62	50.5%
Services	7.64	6.74	88.2%	5.29	69.2%
Total	$877.63	$619.52	70.6%	$413.00	47.1%
December – May 1996					
Lodging	$306.98	$243.03	79.2%	$187.38	61.0%
Food and Beverages	216.84	174.10	80.3%	138.93	64.1%
Transportation	224.02	104.13	46.5%	52.42	23.4%
Boating	26.72	24.47	91.6%	15.88	59.4%
Fishing	17.51	16.84	96.2%	16.36	93.4%
Scuba Diving/Snorkeling	7.18	6.90	96.1%	6.72	93.6%
Sightseeing	26.81	19.22	71.7%	13.04	48.6%
Other Activity Expenditures.	16.73	12.85	76.8%	7.34	43.9%
Miscellaneous Expenditures	60.39	48.96	81.1%	38.99	64.6%
Services	19.29	16.67	86.4%	12.98	67.3%
Total	$922.47	$667.17	72.3%	$490.04	53.1%

SOURCE: Economic Contribution of Recreating Visitors to the Florida Keys/Key West by English, Kriesel, Leeworthy and Wiley

The table indicates that the largest expenditures are for lodging, transportation, and food and beverages. Visitors during the winter/spring season spend slightly more money than during the summer/fall months.

By attracting visitors to the area, Dry Tortugas National Park has an effect on Monroe County's economy. The Office of Social Science, Socio-Economic Studies Division of the National Park Service has prepared a money generation model (MGM) that provides a way to estimate economic benefits of parks to local areas. The local area is defined as the county in which the federal land is located. In fiscal year 1994, the Florida Atlantic University / Florida International University (FAU/FIU) Joint Center for Environmental and Urban Problems conducted a survey of federal lands. Using the money generation model, contributions to the county's economy from Dry Tortugas visitor expenditures were $10,486,792 in sales benefits, $734,075 in tax revenue benefits, and 315 jobs.

COMMERCIAL SERVICES

Commercial services is an umbrella term that is used in this document to encompass any service or facility use in a park that involves the exchange of money. The two main types of commercial services are concession contracts and commercial use authorizations (CUAs). Until recently, commercial use authorizations used to be called incidental business permits and are still referred to as permits or CUA permits. (NOTE: This kind of permit is not the same as the permit that visitors might be required to obtain under some alternatives to visit the park.)

Commercial services at Dry Tortugas are managed by personnel at Everglades National Park with assistance from operational staff at Dry Tortugas. They prepare and negotiate all concession contracts and issue all CUA permits. Their duties include monitoring commercial use authorizations, performing regular inspections and evaluations, and answering all questions related to commercial services from the public and interested businesspeople.

There are currently no major concession contracts to provide goods or services at Dry Tortugas National Park. All commercial services are authorized by commercial use authorizations. One of the objectives of this amendment is to give direction to managing commercial services at Dry Tortugas. Therefore, there is a temporary moratorium on issuing new CUA permits until this amendment is approved. Table 9 presents the number of CUA permits currently issued by activity.

TABLE 9. CUA PERMITS ISSUED FOR THE 1999 SEASON

Activity	Number of CUA Permits Issued
Airplane transportation	4
Water transportation	8
Sailing	11
Fishing	17
Scuba/Snorkeling	6
Birdwatching	9

NOTE: Some operators have CUA permits for more than one activity.

There are currently 55 CUA permits. They are issued for a two-year term, and a fee of $250 is charged to cover the administrative costs of issuing the CUA permit and monitoring the activity. No other fees are collected by the National Park Service. The CUA permits contain several conditions to manage the use depending on the activity. For instance, all operators must have liability insurance. Maximum vessel lengths and maximum passenger limits are stipulated and enforced through monitoring. Operational conditions such as time limits on the use of the dock at the fort are also stipulated. Seaplanes are limited to five at any given time, and they must have floats or beaching capabilities. CUA permits also outline which types of interpretation/ information are appropriate and how to research the information. Finally, those with CUA permits are subject to the same park regulations as other visitors, including area closures and use limits and fishing, trash, sanitation, anchoring, docking, and camping regulations.

The Park Services does not operate any public transportation. All visitor transportation services to the park are commercially operated through one-year or two-year-term commercial use authorizations. Two permit holders operate the *Yankee Freedom* and the *Sunny Days*, both of which operate out of Key West and can carry the maximum number of passengers currently allowed (100). Both operators recently upgraded their fleets with larger and faster boats. There are 40 CUA permits issued to smaller boats that bring customers to the park from all over south Florida, and there are four CUA permits issued to seaplane operators. Also, numerous private boaters come to the park from all over South Florida.

There are two other ways, currently, of managing commercial activities in the park. The National Park Service has a cooperative agreement with the Florida National Parks and Monuments Association to sell books, videos, and related products about the flora, fauna, and history of the park. Inside the fort on Garden Key there is a small book sales area in the visitor center. Through a limited concession permit, the association also sells convenience items such as water, film, and sunscreen. Also, requests for commercial filming are occasionally received at the park. Each request is evaluated independently and approved, approved with conditions, or rejected under a filming permit. Conditions include limits on resource impacts, the mitigation of any resource impacts that might occur, and no undue interference with the enjoyment and use of the park by the general public.

Dry Tortugas National Park is administered by a park superintendent headquartered near Homestead, Florida. The superintendent is responsible for the management of both Everglades and Dry Tortugas National Parks, and the deputy superintendent functions as chief of operations for both areas.

Management of the Dry Tortugas is organized into the following divisions: administration, visitor protection, science and resource management, maintenance, and interpretation. Staff in each division is stationed at Fort Jefferson. Administrative functions including payroll, budget, procurement, contracting, and human resources are accomplished primarily at park headquarters. In addition, the headquarter's and South Florida National Resource Center staffs coordinate research and resource monitoring activities.

Responsibilities of the visitor protection division include managing for visitor safety and experience, contacting visitors on board vessels, and performing search and rescue activities. Staff in this division also participates in some interpretive tasks and manages the campground. The maintenance division is responsible for the operation and maintenance of all park facilities and equipment including utilities (water, wastewater, power, and solid waste), buildings, grounds, employee housing, docks, and boats. The interpretation division is responsible for interpretive programs and exhibits and education, and division staff helps in the bookstore.

PARK OPERATIONS

Staff

Permanent full-time positions on site at the Fort include four park rangers in visitor protection, one park ranger in interpretation, one maintenance supervisor, one maintenance mechanic, one general equipment mechanic, one maintenance worker, and one administrative assistant. In addition, there is one seasonal maintenance worker. Park staff believe the number of current employees would need to be doubled to stay current with facility maintenance and to make adequate contacts with visitors.

There is no park staff at Loggerhead Key. The park relies on a variable number of volunteers who commit to stay on the island for at least one month. The volunteers operate the generator and reverse osmosis plant, accomplish facility and site maintenance, and contact visitors who come to the island.

Health and Safety

New Florida state regulations require water quality monitoring of public beach areas. The regulations require the park to sample the water weekly for bacteria such as *enterro cocci* to determine if conditions are safe for swimmers. Water samples must reach a certified laboratory within six hours for testing. According to park staff, one high reading has occurred in the past. Potential sources include waste from the large number of birds in the area, boats pumping bilge water into the ocean near the fort, and leachate from a leachfield on Garden Key.

Another health issue involves the lack of freshwater facilities for visitors. There is a freshwater drinking fountain at the visitor center, but there are no showers for campground users and no freshwater sinks for visitors using the restrooms at the dock. One saltwater sink on Garden Key is used for fish cleaning, but saltwater is not appropriate for visitor bathing needs. Visitors can easily become dehydrated by not drinking enough fluids while in the area.

Potential safety hazards include sunburns for visitor using the beach area and visitors contacting and sustaining injuries from marine life such as coral, sting rays, and jelly fish; boats sinking; and boats tangling in anchor lines or one boat bumping and puncturing another. In addition, groundings have occurred at Long Key and on various reefs.

The trail around the top of the fort presents a safety hazard for visitors and employees. The top of the fort is 50 to 60 feet above the sea, and in some places the trail is only 3 to 4 feet wide. There are no safety railings along the wall, and the potential exists for a visitor to fall, especially when tour groups concentrate in one area of the trail. Also, bricks occasionally fall from the fort structure, presenting another safety hazard.

In the past, hazardous materials spills of gas, diesel fuel, and propane for cooking have occurred, primarily during transport, loading, and dispensing. The park now has a spill prevention and counter measure plan in place. Boom equipment for unloading and absorbent materials for spills are available. In addition, the U.S. Coast Guard licenses the person making deliveries. However, additional training is needed for staff handling these materials.

Old landfills have begun to emerge at the north coaling dock and on Loggerhead Key. The landfill at the north coaling dock likely contains heavy metal contaminants because it was an incinerator site. It is uncertain how hazardous materials were handled at Loggerhead Key before the U.S. Coast Guard left the site in 1994. No hazardous materials inventories have been conducted for either Garden Key or Loggerhead Key.

Utilities

On Garden Key electrical power is supplied for current housing needs by three 100-kilowatt generators and one 120-kilowatt generators; only one runs at any given time. Three 6,000-gallon underground tanks store diesel fuel to power the generators, which are running at 85% capacity. Seventy-six percent of the fuel consumption is related to humidity and air-conditioning. Power generation is adequate for current uses, but additional power requirements, such as an increase in facilities, would result in the need for additional power generation.

Potable water is supplied through a reverse osmosis (desalinization) process. The process provides about 800 gallons of water suitable for drinking in a 10-hour period. The water is stored in a cistern in the parade ground and is used primarily by park staff. The cistern's capacity will be 90,000 gallons when leaks are repaired, which will be sufficient for current and future needs of onsite staff. The capacity is not sufficient to handle visitors' freshwater needs. There also are cisterns beneath the casemates, which are not used for potable water storage because seawater leaks into them.

There are two septic systems on Garden Key with tanks feeding into one of four leachfields. A 2,000-gallon tank, which feeds into one leachfield, is by the dock for the visitor restroom. A 2,390-gallon capacity tank in the parade ground services staff housing units and feeds into one of three leachfields, which are rotated on a monthly basis. The dock septic system is not adequate for current visitation and must be pumped at least three times a year. The parade ground septic system will not tolerate any further expansion. None of the leachfields meet regulations because tidal-influenced groundwater reaches the lower elevation of the field pipes.

On Loggerhead Key, two aboveground 3,000-gallon tanks store diesel fuel to operate three 50-kilowatt generators. These generators can provide more electrical power than is needed to support the residences. The lighthouse lantern runs on solar power. The reverse osmosis plant has the capacity to produce 500 gallons of potable water in a 10-hour period, but does not operate at that capacity unless needed because consumption determines production. Detailed information regarding the septic system on Loggerhead Key is unavailable. The septic tanks are working but are constructed of cast iron that is badly corroded and needing replacement. On both Garden Key and Loggerhead Key the leachfields need replacement with a raised system or deep well injection system to meet current regulations.

All solid waste brought into the park must be removed and disposed of on the mainland. The *Activa* hauls refuse items such as glass, tin, aluminum, scrap metals, lubricants, batteries, and recyclables to Key West for disposal. The state of Florida has given the park permission to burn noncontaminating paper, vegetation, and wet trash within the park. The park has solicited proposals for the preparation of a solid waste management plan.

Marine Operations

The *Activa*, a 65-foot diesel-powered crew supply vessel with a crew of two, provides transportation to and from the park for NPS employees and their families as well as logistical support for transporting the mail, groceries, household goods, and operational supplies. The *Activa* runs trips for support of construction and rehabilitation projects, research work and search and rescue operations.

The park has several smaller boats ranging from 18 to 26 feet long, including three Boston whalers, a Mako, and a Parker. These boats are used for visitor protection, search and rescue, and research. The number of boats is adequate for the park's current needs. However, there is no cyclic funding or continued funding for upkeep of the boats and related navigational and safety gear, which presents a safety issue for staff.

Monitoring

See the discussions of monitoring in the "Natural Resources" and "Cultural Resources" sections.

Visitor Protection

Visitor protection staff is composed of three commissioned law enforcement positions (and another that is being hired), and one patrol ranger. Their tasks include maintaining radio, weather monitoring, and vessel navigational equipment; emergency medical services; search and rescue operations; pest, exotic plant, and endangered species management or surveys; fire protection service; equipment installation; ordering supplies and maintaining inventory records; campground management; boating safety inspections; fisheries inspections; demarcation buoy and mooring buoy management; park vessel and safety equipment upkeep; park dive team duties; transportation services for supplies, transporting personnel and equipment to other island sites; and assistance to other law enforcement agencies. During peak visitation periods, the patrol ranger spends much of his time performing harbor and dock master duties to allow use of the dock for as many visitors as possible. Because the park staff is small in number, rangers also become involved with day-to-day park operations and lend assistance to other divisions in completing necessary projects.

Conducting patrols in the park is another task that rangers perform. Sensitive areas are patrolled when visitor protection staff observes or receives notice of suspicious activities. Otherwise, patrols are conducted when time permits staff to be away from other duties and during nonpeak visitation periods. Two additional base patrol rangers are being hired, but this increase still will not allow for two law enforcement personnel to be on duty for each shift. The lack of adequate staff becomes a safety issue when a ranger must patrol and board a vessel alone. The park needs a reliable radio communications system for patrolling rangers, especially when they might be dealing with drug or smuggling operations or performing search and rescue operations.

The park receives a variety of visitors including commercial fishing fleets seeking safe anchorage, live-aboard vessels, sailing and recreational fishing vessels, and daily ferryboats from the mainland. Rangers contact these park users to inform them of park regulations and check vessels for safety or resource violations such as illegal fishing or removal of resources. Park staff also uses radar to identify locations of visitors in the park and to determine if poaching or removal of objects from submerged cultural resources is occurring.

FACILITIES

Visitor Center

The visitor center at the fort is open year-round. Visitors can obtain park information, purchase materials in the bookstore, and see interpretive exhibits and a video describing the park's history and natural resources. The visitor center encompasses two casemate spaces and is in need of improvements. Water leaks into the spaces, and the climate control system does not adequately protect the exhibits. Also, the size of the visitor center is not adequate to permit updating and adding to the interpretive program.

There are no formal visitor services on Loggerhead Key, and ferry service vessels are not allowed to use the small dock. The facilities on the island include two quarters structures for volunteers, the lighthouse, and various support structures for the utility systems.

Campgrounds

On Garden Key there are 13 campsites available on a first-come, first-served basis for $3.00 per person per day. Eleven campsites are individual sites that accommodate up to six people or three tents each. There is one group site that accommodates about 40 people, and an overflow site for 40 or more campers. Picnic tables and a charcoal grill are associated with the campground. Salt-water flush toilets at the dock are available for visitor use, but there are no shower facilities or freshwater sinks. Visitors must bring in all supplies, including fuel, water, ice, food, and convenience items, and carry out all trash and garbage when they leave. During peak periods such as the spring birding season or holiday weekends, the campground is overcrowded and the dock septic system is overstressed.

Anchorage and Buoys

Anchoring is currently permitted throughout the park, and overnight anchoring is restricted to within 1 nautical mile around the fort. Resource damage is occurring in some areas of the park due to anchors being dropped on or dragged through coral reefs.

There are 17 boundary buoys, nine of which are lighted, and about 25 daymarker navigational aids that mark the channel, directing boats in the harbor near the fort. The U.S. Coast Guard currently performs annual maintenance on the buoys.

Mooring buoys are used only for visitor services. Currently, there is only one buoy in use in the park at a shipwreck site (the *Windjammer* site), which is used for snorkeling and diving. Buoys require monthly inspections for damage and cleaning every three months, and mooring lines need replacement every two–three years. Each buoy costs between $400 to $800 to install including materials, special tools, and labor.

Park Housing

Most park employees at Garden Key live in housing units that are built into casemates of the fort. Of the 14 total housing units, 11 are constructed within the casemates using the historic walls and ceiling as part of the structure. One unit is a prototype that was installed in July 1999 and is self-contained and does not use any of the fort's historic fabric. The remaining two housing units are in former officers' quarters.

The casemate inserts that use part of the fort as structure have a limited life span, primarily because of humidity and large amounts of water that leak in when it rains. The quarters do not meet code and are an inconvenience when mortor from the fort falls into employee's food and onto furniture and clothes. On Loggerhead Key there are two single-family residences that provide housing for the researchers, volunteers, and work crews. There is a three-bedroom condominium in Key West for employees to share when they are off duty.

Dock

The Fort Jefferson dock at Garden Key is about 120 feet in length at the face of the pier. The front face can be used for public docking when not being used for operational needs such as the loading and unloading of supplies, fuel, etc. Docking is allowed between sunrise and sunset, and each vessel is allowed up to two hours docking time unless there are other vessels needing access. Ferry vessels are restricted to 100 feet in length. These vessels tie up to the dock at the fort only long enough to drop off passengers and then anchor elsewhere until it is time to pick up the passengers for departure.

The north end of the pier is the NPS supply vessel *Activa's* berth, although it may also be used by the public when the *Activa* is not in port.

Any vessel longer than 120 feet blocks the use of the north side dock area. Other vessels, such as U.S. Coast Guard vessels, research vessels, commercial scuba diving vessels, small yachts, recreational fishing vessels, etc., are often more than 60 feet long and take up the entire front face of the dock. In addition, vessels contracted for special services, including bringing fuel or large heavy supplies and pumping the septic tanks, require considerable dock time.

Crowding occurs at the dock between December and May and during major holiday weekends when many different visitor groups come to the island at the same time. In addition to the ferry services, these visitors include people from sailing boats, recreational fishing vessels, birdwatching groups, and people from commercial fishing boats who want to dock to use the picnic facilities.

Also needing dock time are vessels with mechanical problems that are seeking help at the fort and requiring communication with the mainland. However, the park does not have the resources to provide parts or assist with repairs. The park follows the marine tradition of granting safe harbor — granting free and open access to the protected area at Garden Key to vessels during storms or emergencies.

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The National Environmental Policy Act (NEPA) requires that environmental documents discuss the environmental impacts of a proposed federal action, feasible alternatives to that action, and any adverse environmental effects that cannot be avoided if the proposed action is implemented. The following portion of the this management plan analyzes the environmental impacts of the five alternatives on natural resources, cultural resources, the visitor experience, the socioeconomic environment, and park operations and facilities. The analysis is the basis for comparing the beneficial and adverse effects of the alternatives.

The alternatives are primarily conceptual, and most potential consequences are presented in qualitative terms. If and when specific developments or other actions are proposed subsequent to this *General Management Plan Amendment / Environmental Impact Statement*, NPS staff will determine whether more detailed environmental documentation is needed in accord with NEPA requirements.

Impact analysis discussions are organized by impact topic and then by alternative under each topic. Methodologies used in the environmental impact analysis precede discussions of the impacts. Each resource topic discussion also details cumulative impacts and presents a conclusion. Alternatives B, C, D, and E follow a similar format but omit the methodology discussion.

According to regulations developed by the Council on Environmental Quality (CEQ), regulation 1508.7, a cumulative impact is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

There are several other plans by other organizations and agencies (see the "Relationship to Other Planning Efforts" section) that could also affect the park's natural and cultural resources as well as the socioeconomic conditions. The National Park Service is aware of these plans and is working in coordination with these other efforts.

The intensity of the impacts described below considers whether the impacts would be negligible, minor, moderate, or major. These designations are used to describe both beneficial and adverse impacts. Negligible impacts were effects considered detectable but would have no principal effect on biological resources and habitat. Minor impacts were effects that were detectable but not expected to have an overall effect on natural community structure. Moderate impacts would be clearly detectable and could have an appreciable effect on individual species dynamics, community ecology (e.g., the numbers of different kinds of fish present), or natural processes. Major impacts would have a substantial, highly noticeable influence on natural resources. This would include impacts that have a substantial effect on individual species, community ecology, or natural processes.

INTRODUCTION

During the past 14 years, visitation at Dry Tortugas National Park has quadrupled, rising from 18,000 visitors in 1984 to just under 72,000 visitors in 1998 and 84,000 in 1999. Most visitors come between March and July, averaging about 245 people per day in the park. The increased popularity is putting excessive stresses on park facilities, visitor safety, and the quality of the visitor experience. Human activities have been widely implicated for negatively impacting the ecological balance of the Florida Keys ecosystem (Voss 1988). Visitors to the Tortugas have been implicated in loss or degradation of vegetation, wildlife, and sensitive habitats through excessive use, improper contact, and physical manipulation of resources. Also, the direct effects of water, terrestrial, and noise pollution are of substantial concern to the quality of these sensitive environments that support economically important fisheries and ecologically important bird, fish, and turtle breeding, nesting, and feeding habitats. Other marine recreational activities like diving and boating have the potential to damage sensitive environments and habitats like coral reefs through contact.

Concern about habitat degradation and escalating resource uses from population growth in southern Florida resulted in the establishment of the Florida Keys National Marine Sanctuary in 1990 and the national park in 1992. The park's mission is to maintain near-pristine resource qualities, but forecasted trends in increased visitation may destroy the very resource qualities that make the area special as well as degrade the experience of some visitors. As described in this document, there are a variety of human uses that have the potential to impact the park's natural environment.

This section analyzes the potential effects or impacts of implementing five alternatives that have been proposed for the management of Dry Tortugas National Park (appendix G, figure B5). Each of these alternatives has a different application of the four management zones — the research natural area zone, the natural/cultural zone, the historic preservation/adaptive use zone, and the special use zone. Each zone provides different levels of protection and human use of the natural environment and resources, thereby providing varying levels of risk to the park's resources. The management zone providing the greatest level of protection to the park's resources is the research natural area (RNA) zone, referred to in the literature as marine reserves, marine protected areas, or ecological reserves. (The support for the use of the research natural areas and the impacts of establishing such an area was described in the "Alternatives, including the Proposed Action" section.)

METHODOLOGY

The environmental impact analysis provides a framework for assessing the relative risk of implementing each management alternative to the natural resources of the park, as well as the expected level of degradation due to human use. The environmental impact analyses consists of two quantitative assessments — a simulation study of the impacts of implementing each of the alternatives on fisheries and their essential and unique habitats and an analytical hierarchy modeling process of the cumulative impacts on all relevant ecosystem components of the park's natural resource environment. The sampling cruise conducted in 1999 (Ault and Bohnsack 1999) provided excellent data from which to conduct quantitative analysis and modeling experiments on both the habitats and fishery resources of the park.

Methods used include analyzing the amount of area set aside for protection in conjunction with visitor carrying capacities (see appendix D), the health of the coral reef system (the diversity, abundance, size, and distribution of the reef fish community), the use of a spatially and temporally dynamic population simulation model to simulate the impact of the alternative management plans on the snapper, grouper, and grunt reef fish populations (as well as hogfish) from Key West out to the Dry Tortugas region, and the use of an analytical hierarchical process (AHP) model to allow resource managers to structure and execute hundreds of quantitative and qualitative assessments simultaneously to evaluate alternatives and rapidly calculate summary values. (The analysis as to which management alternative provides the best protection for the park's resources is structured as an AHP model.) For further details on these methodologies, see appendix I.

ALTERNATIVE A

Impacts on Essential and Unique Habitats.

Coral Reefs. Boaters have been identified as sources of detrimental impacts on coral reefs, either through grounding (propeller damage) or inadvertent placement of anchors on these sensitive and valuable habitats (Davis 1977). Although anchor damage can be largely eliminated through the use of mooring buoys, the concentration of use in a small area and even the actual placement of the mooring buoys can damage sensitive corals, sponges, and seafans on the reefs. The current high levels of unrestricted boat use and access within all areas of the park under this alternative would continue to cause major short- and long-term adverse localized impacts on coral reefs.

The complexity and beauty of coral reefs make them an attractive and valuable resource for ecotourism (Davis and Tisdell 1995). However, coral reefs are very sensitive to disturbances, and assessment of their diver carrying capacity and damages caused by sport diving is essential for their management. Both snorkelers and scuba divers have been implicated in the loss of coral and coral productivity. Although the effects of other human activities on coral reefs have been documented (e.g., coral mining and dynamite fishing), a limited number of studies have focused on the damaging effects of sport diving.

These limited studies were reviewed by Davis and Tisdell (1995), who found that most were focused on spear-fishing and snorkeling, with the least attention given to scuba diving. Most studies have been based on observations of diver behavior (e.g., Rouphael and Inglis 1995 and 1997), and usually compare damage found on heavily dived reefs relative to undived areas (Davis and Tisdell 1995). Riegl and Velimirov (1991) established quantitatively that fast-growing, relatively brittle branching corals suffer the most damage in the Red Sea. Most diver damage on reefs is unnecessary, but the intensity and severity is directly related to susceptibility to damage of certain coral species in the reef community and their use levels by humans (Riegl and Velimirov 1991, Hawkins and Roberts 1992, Rouphael and Inglis 1995 and 1997, Allison 1986). Diver damages might be avoided by modifying diver behaviors (Rouphael and Inglis 1995, Allison 1986, Medio et al. 1997, Hawkins and Roberts 1992), limiting diving to the sustainable carrying capacity of the reefs (Davis and Tisdell 1995, Hawkins and Roberts 1992), and managing coral reefs in terms of their susceptibility to damage (Rouphael and Inglis 1995).

Current levels of unrestricted access to coral reefs, particularly coral reefs in shallow areas, by fishermen, scuba divers, snorkelers, and swimmers result in moderate levels of long-term adverse impacts on these reefs. The continuation of these use patterns would allow stress and damage accumulation in conjunction with boat damage. Because alternative A provides no research natural area zone protection to the park's essential and unique habitats, this alternative would continue to provide no improvement over current conditions or protection from future increased use.

Sea Grass. Boaters have been identified as sources of detrimental impacts on sea grass beds either through grounding (propeller damage) or inadvertent placement of anchors on these sensitive and valuable habitats (Davis 1977). These human impacts are obvious in the Florida Keys, such as the approximately 30,000 acres of sea grass that have been propeller scarred by boaters (Sargent et al. 1995). The current high levels of unrestricted boat use and access within all areas of the park under this alternative would continue to cause major short- and moderate long-term adverse localized impacts on sea grass beds. The loss of sea grass has also been linked to increased levels of turbidity due to the destabilization of the bottom sediments.

Hardbottoms. Boaters have been identified as sources of detrimental impacts on hardbottom communities either through groundings (propeller damage) or inadvertent placement of anchors on these sensitive and valuable habitats (Davis 1977). Although anchor damage can be largely eliminated through the use of mooring buoys, the concentration of use in a small area and even the actual placement of the mooring buoys can damage the sensitive soft corals, sea fans, and sponges of the hardbottom communities. The current high levels of unrestricted boat use and access within all areas of the park under this alternative would continue to cause major short- and moderate long-term adverse localized impacts on these communities.

Sand Bottoms. Boat use over shallow sand areas can result in increased turbidity due to suspension of sand and particulate material. Although there is no direct damage done to the sand, increased turbidity can have detrimental impacts on surrounding coral reef, hardbottom, and sea grass communities by the reduction of ambient light levels and by sedimentation coating the surfaces of sensitive organisms like corals and sea grass, inhibiting normal growth and feeding. Current levels of boat use do not appear to present any long-term detrimental impacts. Minor short-term impacts would occur when boats are run over shallow areas, increasing turbidity in surrounding areas. Future increases in boat use would pose moderate short-term impacts because there are no restrictions on boat use or access under this alternative.

Terrestrial Habitats. Although access to some terrestrial areas of the park would continue to be restricted or prohibited under this alternative, other island areas would allow complete access to visitors. Unmonitored use of these terrestrial habitats for picnicking, camping, wildlife viewing, walking, etc. would likely continue to cause major short-term and moderate long-term deterioration of island flora. The prevention of any further facility construction would provide some level of protection to the terrestrial resources by preventing the major damage caused by such an undertaking.

Impacts on Fishery Resources

Exploited Reef Fish. Reef fishing can target a number of economically and ecologically important species (e.g., groupers, snappers, lobsters, conch, sponges, and corals). The multispecies reef fisheries of the Florida Keys are under siege from fleet expansions and increased vessel fishing power that threaten to overexploit, destroy habitat, change marine environments, and reduce biodiversity (Bohnsack and Ault 1996). During the past several decades, public use and conflicts over fishery resources have increased sharply, while some fishery catches from the historically productive snapper and grouper stocks have declined (Bohnsack et al. 1994; Ault et al. 1997 and 1998). The Florida Keys are now considered an "ecosystem-at-risk" as one of the nation's most significant yet most stressed marine resources (NOAA/NMFS 1999). The reported serial overfishing of exploited reef fish stocks for the Keys (Ault et al. 1998) is strikingly similar to the current situation observed in the Tortugas, despite the region's relatively remote location some 70 miles west of Key West.

Recent quantitative assessments of the multispecies reef fish community in the Florida Keys showed that fishing mortality levels are very high, that many stocks are overfished, and that exploitation has altered the structure and dynamics of the reef fish community (Ault et al. 1998). As reef fish stocks continue to decline, the picture of exploitation potential in the park is rapidly increasing. The Tortugas provides the last good fishing grounds for a rapidly growing fleet of anglers equipped with technological innovations such as GPS (global positioning system) and better and faster vessels that magnify the effectiveness of the fishermen. Pressures for increased fishery production will continue to escalate as human populations swell in the region. Many observations in the past 100 years suggest that many well-known individual species of the Tortugas region are now potentially rare, threatened, or endangered.

Currently, more than 60% of the reef fish in the Florida Keys are overfished by government standards and in need of further management intervention (Ault et al. 1998). Although the reef fish populations in the park appear to be in a better condition than the rest of the Keys, they are still overfished. The simulation results (see appendix I) showed that a majority of the snapper, grouper, and grunt stocks would decline during the next 20 years without management intervention. Current levels of exploitation would continue to result in long-term major adverse impacts on the exploited reef fish stocks in the park, reducing the value of the park to almost all users, including fisherman, scuba divers, and snorkelers. As reef fish stocks begin to collapse and become more rare, the diversity, abundance, size, distribution, and balance of the reef fish community would become further degraded. Because alternative A contains no research natural area zone, it offers no further protection to the diversity of the reef fish community or protection from increased impacts.

Other Species. Unexploited reef species — sharks and rays, pelagic species, and baitfish — are intricately linked to the health of the reef environment and to the dynamics and resiliency of the exploited reef fish community, which either preys upon or is the prey of these groups of fish. These unexploited reef fish species would be impacted indirectly, through habitat degradation and the dynamics of the exploited reef fishery, and directly through accidental catches by recreational fisherman. The delicate balance of the coral reef ecosystem is easily upset by the impacts of habitat degradation and selective fishing on key predator species. The combination of these factors, under current levels of park access and fishing mortality, would continue to present a major short- and long-term adverse impact on these exploited and unexploited fish populations.

The remoteness of the Tortugas has historically kept pressures from human population growth, widespread overfishing, and pollution at low levels. For several decades the Tortugas region has supported the Keys with larvae and the export of adult fish, which has provided critical support to the multibillion-dollar fishing and tourist economies. Proposed changes in park natural resources management would likely enhance the conservation of its unique qualities as well as the function, dynamics, and productivity of the wider Florida Keys ecosystem. Maintenance of the park's natural resource ecosystem has considerable implications for ecosystem resiliency and the sustainability of fisheries (Lott 1996, Lee et al. 1999, Schmidt et al. 1999). These facts make the observed declines in the reef fish community and the great risks of further adverse impacts extremely important concerns for park managers and those involved with the entire Florida Keys ecosystem.

Impacts on Wildlife Resources

Birds. The sanctity of the park as a haven for seabirds and their nesting sites is becoming increasingly jeopardized by the growth of human activities and resource uses in the Tortugas region. Although most of the birds and their nesting sites are currently protected, the levels of human use and access within the park would continue to present major long-term adverse impacts on the adult birds, because these uses often result in death. Impacts on adult birds are due to overharvesting of baitfish food sources, changes in prey base or community composition through overfishing and noise disturbances from boats and aircraft overflights.

The seemingly minor noise distractions from boats and planes can potentially be fatal for eggs and nesting young, thus resulting in major short- and long-term impacts for these life stages. With increases in park use, noise levels would inevitably continue to increase, threatening successful nesting. Visitor education and compliance with rules protecting the natural soundscape would mitigate these impacts somewhat. Several additional threats to nesting sites and the young of seabirds in the park have been identified. The major sources of degradation and/or loss of nesting sites include disturbance by visitors, noise from planes and boats, exotic plant invasions, erosion, and exotic rats that eat eggs and young, resulting in major short- and long-term damages.

Turtles. The sanctity of the park as a haven for marine turtles and their nesting sites is becoming increasingly jeopardized by the growth of human activities and uses in the Tortugas region. The current levels and access throughout the park of recreational boaters with little knowledge of the area would continue to result in major short- and long-term adverse impacts on turtles swimming in the park due to mortality from collisions with boats and/or propellers. The most important human-associated source of mortality is incidental capture of turtles in shrimp trawls, which accounts for more deaths than all other human activities combined (NPS 1998). This occurs near the park boundaries. Other threats are the ingestion of marine debris and entanglement in active and passive fishing gear (Glenn 1996).

Several threats to nesting sites of sea turtles in the park have been identified. The major sources of degradation and/or loss of nesting sites include disturbance by visitors, artificial lighting, exotic plant invasions, erosion, exotic rats that eat eggs and young, aircraft overflights, and predation by ghost crabs, which eat turtle eggs. With increases in park use, noise levels would inevitably continue to increase, threatening successful nesting. Visitor education and compliance with rules protecting the natural soundscape would mitigate these impacts somewhat.

Although much time and effort is put into protecting nesting turtles and their nests, the current levels of visitor use and unmonitored access to many beach areas would continue to be a moderate short- and long-term threat to the nesting behaviors and nests of the turtles.

Marine Mammals. Marine mammals that reside in or travel through the park would continue to be predominantly impacted by boat propeller damage, inadvertent entanglement in fishing lines, and habitat degradation. Current levels of boat use and unrestricted access to all portions of the park, particularly areas frequented by manatees and coastal dolphins, would continue to present major short- and long-term adverse impacts on marine mammals from collisions and propeller contact — particularly for very young and old individuals that are less mobile and less able to avoid collisions.

Impacts on the Environmental Setting

Demographic trends suggest a quadrupling of human population in the South Florida region during the next 50 years. Human population growth and resource use issues indicate compounding problems due to expected increases in water pollution, noise pollution, and additional lighting associated with increased presence and use. If these issues are not addressed, the resources and qualities that make Dry Tortugas unique could be lost.

Soundscape and Night Lighting. The current levels of visitation focused during certain periods of the year provide a moderate short-term adverse impact on the soundscape and the opportunities to see the night sky in the park. Noise also threatens successful nesting of birds and turtles. As levels of visitation increase, the current management plan would be insufficient to control the escalation in light and noise pollution and would present a major short-term risk.

Low tolerance for activities that degrade the natural lighting and the natural soundscape of the park would decrease these impacts and improve the opportunities to hear the natural sounds and see the night sky, as would education and compliance with night sky and soundscape protection regulations.

Wetlands. There would be no impacts on wetlands under this alternative.

Water Quality. The remoteness of the Tortugas has kept pollution at low levels in the face of population growth, the expansion of development pressures, and harmful changes in water quality.

Nutrient loading is a widespread factor that alters the structure and function of aquatic ecosystems (Valiela et al. 1992). Irreparable damages to the park's sensitive natural resources could result from overuse unless visitation levels and types of activities and their locations were balanced with resource preservation. Potential pollution sources include private and commercial motor boats (fuel leaks, oil spills, sewage, etc.), sail boats, picnicking, camping, photography, and general use. The natural communities that comprise the Florida Keys and Dry Tortugas ecosystem exist in a dynamic equilibrium, and changes that may result in a direct impact on one community type can have profound effects on adjacent or interacting communities. The continued sustainability of this marine ecosystem depends upon the maintenance of clear waters with relatively low nutrients (EPA 1999).

The water quality within the park constantly faces the potential of a minor or major oil or fuel spill caused by grounding of recreational boats, and this threat constitutes a potential major short-term and moderate long-term adverse impact on the park. Under alternative A, this threat would continue. The restriction of any further construction of facilities would provide increased protection of water quality.

Cumulative Impacts

The lack of resource protection proposed in alternative A would place park resources in significant peril of degradation due to these upstream changes and would provide no buffer against external sources of impacts.

The remoteness of the Tortugas has historically kept pressures from fishing and pollution at low levels in the face of rapid regional human population growth, expansion of development pressures, harmful changes in water quality, and widespread overfishing. For several decades the Tortugas region has supported the Keys with larvae and the export of adult fish, which has provided critical support of the important multibillion-dollar fishing and tourist economies in the Keys. Conservation of the unique and significant qualities of the park provides long-term enhancement to the function, dynamics, and productivity of the broader Florida Keys ecosystem. The maintenance of such a system has considerable implications on ecosystem resiliency and the sustainability of fisheries throughout the Florida Keys (Lott 1996, Lee et al. 1999, Schmidt et al. 1999).

The current high levels of unrestricted boat use and access within all areas of the park under this alternative would continue to cause short- and long-term adverse localized impacts on coral reefs, sea grass beds, sand bottoms, and hardbottom habitats. These adverse impacts on the essential and unique habitats in the park would continue to accumulate over time, resulting in greater and greater degradation of resource quality and functioning, and at some point in the future these critical habitats would lose functionality and become unrecoverable.

The park, under alternative A, would not contribute any significant benefits to the system of other proposed research natural areas within the Florida Keys National Marine Sanctuary, the Gulf of Mexico, the Caribbean, or the coast of the United States, but the park could benefit from the implementation of nearby research natural areas such as those proposed by the sanctuary's ecological reserves.

The resource degradation that would occur under alternative A would not only endanger the park resources, but would also diminish the capacity of the rest of the Florida Keys to sustain itself into the future.

Conclusion

Under alternative A, the aquatic essential and unique habitats in the park would continue to face long-term impacts through direct habitat degradation from unrestricted, amateur boat users and through contact from scuba divers, snorkelers, and swimmers. These impacts would be compounded by any oil spills, fuel leaks, waste disposals, etc. and by the expected increase in trash due to increasing visitor use. Fish, shark, and invertebrate populations all use the underwater community in different ways (protection, food, spawning, etc.), and changes in the delicate balances of these multispecies communities due to fishing and other effects would continue to cause compounding adverse impacts on the species and habitats due to shifts in use.

Likewise, the risks of adverse impacts on the essential habitats outside the park under alternative A would continue to compound the direct impacts on the fisheries and wildlife living in the park. The fish, marine mammals, birds, and turtles, habitats, and unique environment of the park all exist in a delicate balance. Changes to any component represent risks to all other components. Implementing alternative A poses a major long-term threat to the overall environmental health of the park's resources.

ALTERNATIVE B

Impacts on Essential and Unique Habitats

Coral Reefs, Sea Grass, Hardbottoms, and Sandbottoms. Management tools available under alternative B would control the maximum number of visitors in certain areas of the park. If in the unrestricted areas of the park established standards for resource quality were exceeded, additional use restrictions would be established to prevent further impairment of these resources. Also, visitor education might limit some damage from anchors and chains. Alternative B would provide slightly higher protection to the habitats of the park compared to alternative A.

Because alternative B provides no research natural area zone protection to the park's essential and unique habitats, it would provide little improvement over current conditions but would enhance protection from the impact of future increased use.

Terrestrial Habitats. Although access to some terrestrial areas of the park would continue to be restricted or prohibited, other island areas would allow complete access to recreational visitors. Improved monitoring of the use of terrestrial resources for picnicking, camping, wildlife viewing, walking, etc. would reduce some of the major short-term and moderate long-term deterioration of island flora due to these uses. If established standards for the management zone for resource quality were exceeded, additional use restrictions would be established to prevent further impairment of these resources. The prevention of any further facility construction would provide some level of protection to the terrestrial resources by preventing the major damage caused by such an undertaking.

Impacts on Fishery Resources

Exploited Reef Fish. The simulation results showed that a majority of the snapper, grouper, and grunt populations would continue to decline during the next 20 years without management intervention (see appendix I). Current levels of exploitation would continue to result in short- and long-term major adverse impacts on the exploited reef fish populations in the park, reducing the value of the park to almost all user groups, including fishermen, scuba divers, and snorkelers.

Other Species. As reef fish populations continue to decline, collapse, and become more rare, the diversity and balance of the reef fish community would become degraded. Because alternative B contains no research natural area zone, it offers no further protection to the diversity, abundance, size, and distribution of the reef fish community or protection from increased impacts. The combination of these factors, under current levels of park access and fishing mortality, would result in major short- and long-term adverse impacts on these populations.

Impacts on Wildlife Resources

Birds and Turtles. Alternative B would slightly increase protection to birds, turtles, and their nesting sites in the park due to limiting overcrowding in areas, spreading out resource use, and applying management tools to limit visitor impacts after certain management zone standards have been reached. Application of the special protection zone to highly sensitive sites during critical nesting periods would significantly limit adverse impacts. Unlimited boater access to the park would still present major short- and long-term adverse impacts on turtles.

Marine Mammals. Alternative B would slightly increase protection to the marine mammals in the park due to spreading out resource use and applying management tools to limit visitor impacts after certain management zone standards have been reached. However, the management zone standards allow some adverse impacts. Unlimited boater access to the park would still present major short- and long-term adverse impacts on marine mammals.

Impacts on the Environmental Setting

Soundscape and Night Lighting. The current levels of visitation during periods of the year result in a moderate short-term adverse impact on the natural soundscape and night lighting within the park. However, as levels of visitation increase, the application of management tools and standards (visitor capacity limitations within areas, the reduction of boat use, and controls on noise levels) would ensure the protection of the night view of the sky and the natural soundscapes.

Wetlands. There would be no impacts on wetlands.

Water Quality. The water quality in the park constantly faces the potential of a minor or major oil or fuel spill caused by grounding of recreational boats, and this risk would continue under alternative B. However, as levels of visitation increase, the application of management tools and standards (visitor capacity limitations within areas and the reduction of boat use) would help decrease the risk to water quality. The restriction of any further construction of facilities would provide increased protection of water quality.

Cumulative Impacts

The risks of adverse impacts on the essential habitats outside the park under alternative B would continue to compound the direct impacts on the fisheries and wildlife living in the park. These cumulative impacts would be less adverse than those in alternative A but would be insufficient to halt the overall degradation of the park's resources.

Conclusion

Under alternative B, the essential and unique aquatic habitats in the park would continue to face long-term impacts through direct habitat degradation from unrestricted, amateur boat users and through contact from scuba divers, snorkelers, and swimmers. These impacts would be compounded by any oil spills, fuel leaks, waste disposals, etc. and by the expected increase in trash due to increasing visitor use.

Fish, shark, and invertebrate, bird, turtle and marine mammal populations all use the park in different ways (protection, food, spawning, etc.), and changes in the delicate balances of these multispecies communities due to fishing and other effects would continue to cause compounding adverse impacts on the species and habitats.

The AHP model results (see figure B13) indicate that alternative B would only be slightly more effective (1.1 times) in achieving the park's goals with respect to natural resources than alternative A. The implementation of alternative B would still pose a major long-term threat to the overall environmental health of the park.

ALTERNATIVE C

Impacts on Essential and Unique Habitats

Coral Reefs, Sea Grass, Hardbottoms, and Sand Bottoms. The introduction of a research natural area zone in the park would significantly reduce the short- and long-term adverse impacts on coral reefs, sea grass beds, sand bottoms, and hardbottom habitats within that zone. Restrictions on private boat use in the research natural area zone would reduce the threat of major damage to underwater habitats from groundings and propellers. The elimination of anchoring and fishing in the research natural area zone would remove the threat of damage to underwater habitats from these activities.

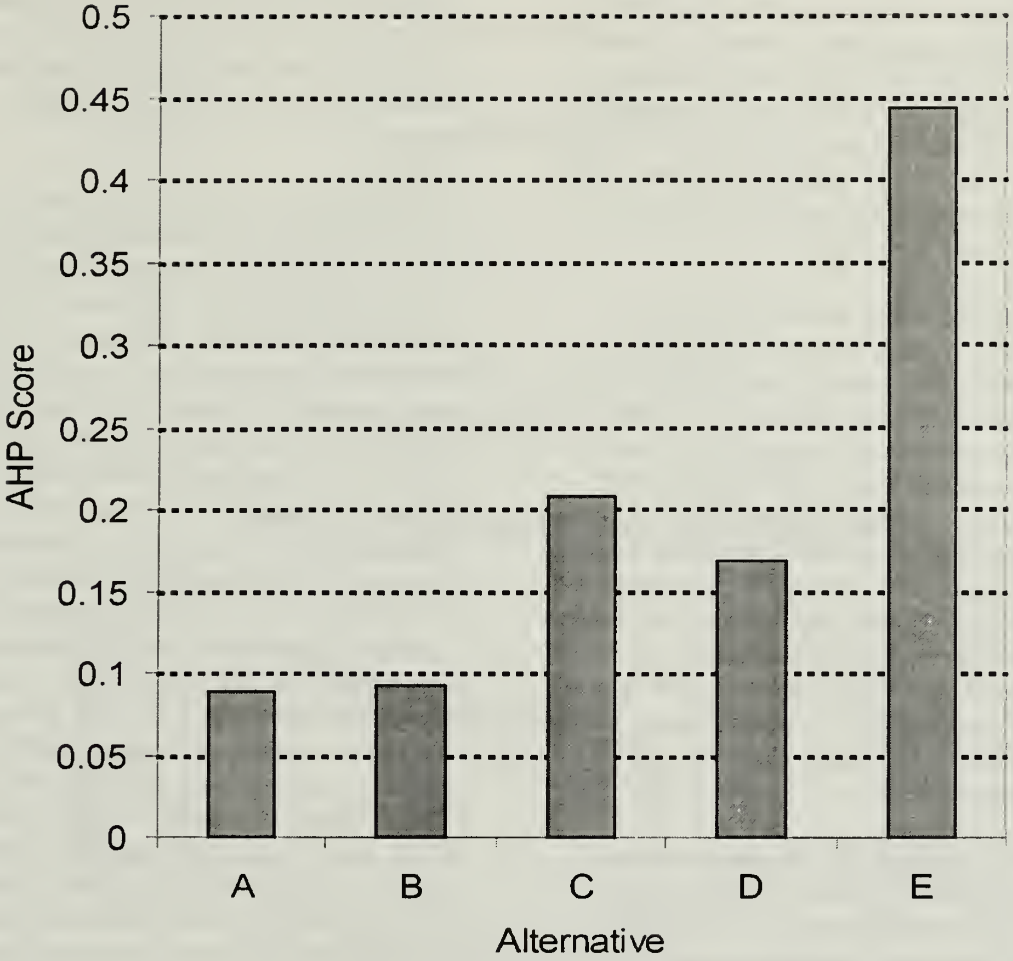


Figure B13: Overall AHP model scores for five management alternatives. Score values reflect the relative effectiveness of a given alternative in achieving the park's goals with respect to natural resources (see appendix I).

Limiting scuba diving, snorkeling, and swimming to deeper, localized areas near mooring buoys in the research natural area zone would significantly reduce the extent of damage to coral reefs from these activities. The research natural area zone would protect 41% of the coral reef habitats in the park, 100% of the hardbottom habitats, 26% of the sea grass beds, and 41% of the sand bottom areas (appendix G, table A2c).

This level of research natural area zone protection would provide a significant increase in habitat quality compared to the no-action alternative (alternative A), and would protect several extraordinary coral reef formations (e.g., Loggerhead Forest). This increased protection would have a beneficial impact on reef formations and associated aquatic life within the research natural area. The aquatic habitats outside the boundaries of the research natural area would still face moderate to major long-term adverse impacts due to use by boaters, fishermen, scuba divers, snorkelers, and swimmers.

Terrestrial Habitats. Monitored and/or restricted access to much of the terrestrial habitat and the use of guided tours would provide increased protection to land-based resources compared to alternative A.

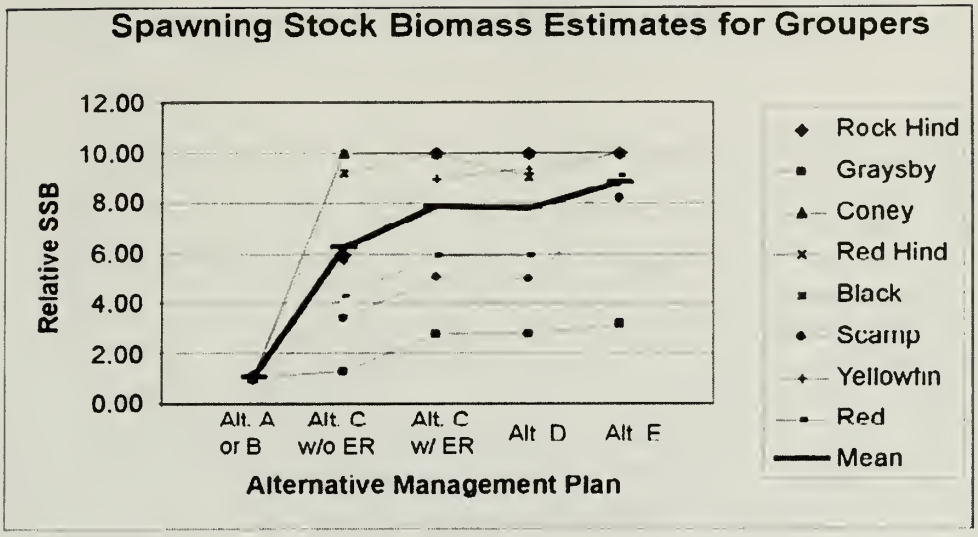
The restriction of any further construction of facilities, except dock expansion, and the shifting of visitor loads to commercial services would provide increased protection to the essential habitats of the park, further decreasing long-term adverse impacts.

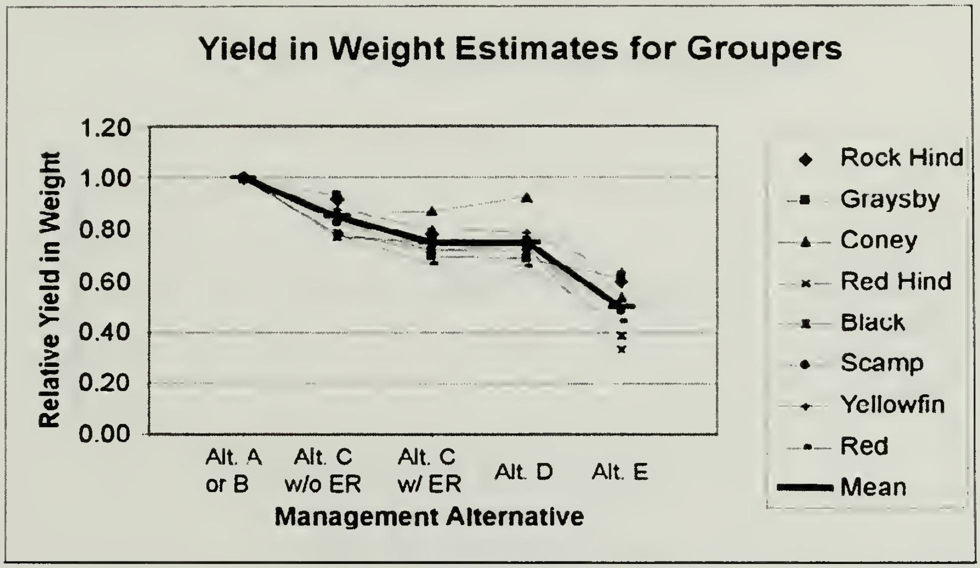
Impacts on Fishery Resources

Exploited Reef Fish. Recreational fishing would not be allowed in the research natural area zone under this alternative. The placement of this zone (see figure B5b in appendix G) would provide greatly increased levels of protection for 88% of the reef fish species found in the park, including 97% of the species in the snapper-grouper-grunt complex (appendix G, table A2c). This level of protection for such a high proportion of the total species in the park would benefit the reef fish community composition and provide stability to the reef fish community and the park's natural resources.

The simulation results (see appendix I) show that in 20 years, the research natural area zone would produce an 800% increase in spawning populations, more than a 1,000% increase in egg production, and only a 20% drop in yield in weight for all species of the grouper complex residing in the park (figure B7). Note that on figures B7, B9, and B11, alternative C without the Florida Keys Marine Sanctuary's ecological reserve is represented but it not one of the alternatives presented in this document. The results for the snappers show a 300% increase in spawning population, a 1,500% increase in egg production, and a 40% decrease in yield in weight (figure B9). Likewise, grunts show a 400% increase in spawning population, a 500% increase in egg production, and only a 20% decrease in yield in weight (figure B11). In addition, individual fish in the stocks would be allowed to grow to larger, naturally attainable sizes within the research natural area zone, attracting scuba divers and snorkelers. Alternative C without the Florida Keys National Marine Sanctuary's ecological reserve, on figures B7, B9, and B11, is not one of the alternatives proposed in this document.

There would be a major short-term and minor long-term adverse impact on fishing yields in the park; however, fish stock biomass and yields would be higher and more sustainable over the long term, and the presence of substantially larger individuals would benefit recreational trophy fishing and commercial yields in water adjacent to the research natural area. Additionally, these larger individuals could leave the boundaries of the research natural area zone at times and could be caught by commercial fishermen or recreational fishermen outside the park seeking these large trophy fish.





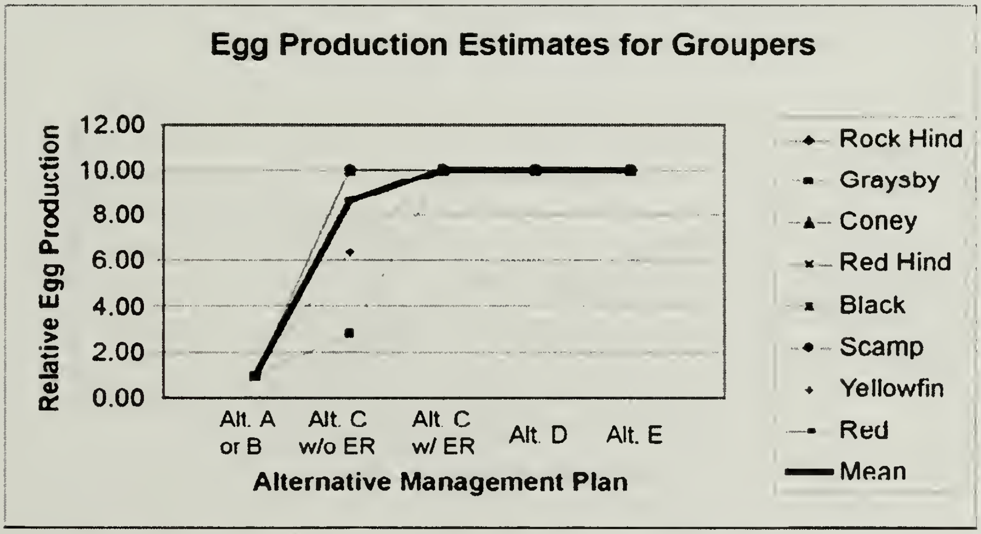
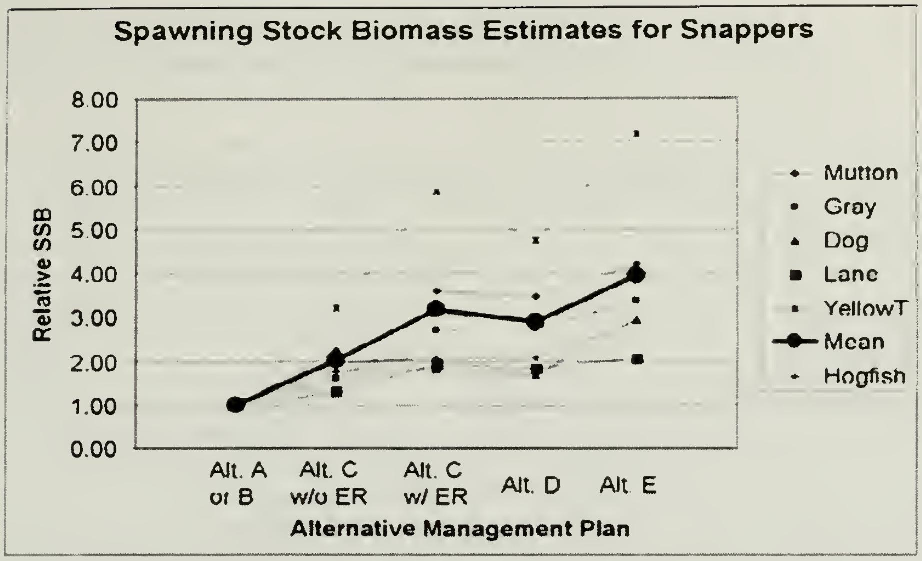
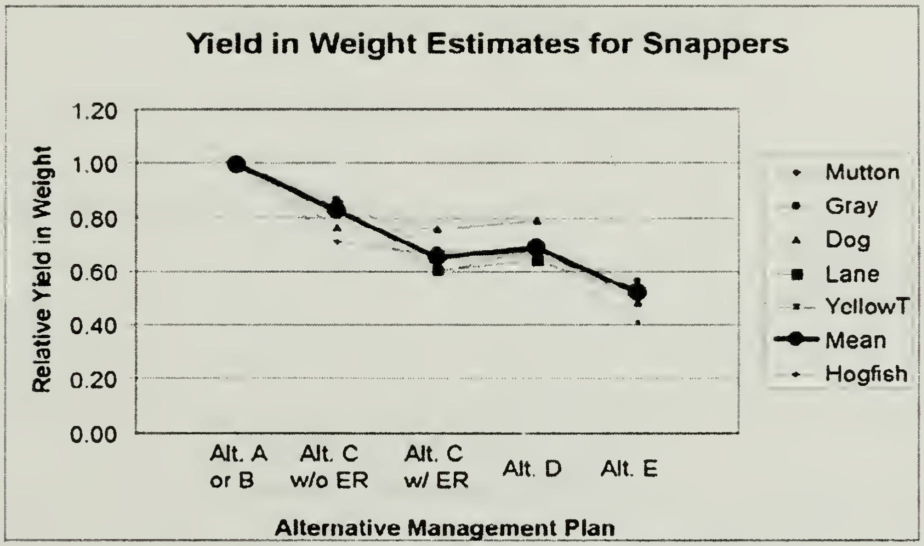


Figure B7: Results of the 20-year spatial simulations of the efficacy of the various management alternatives for all grouper species.





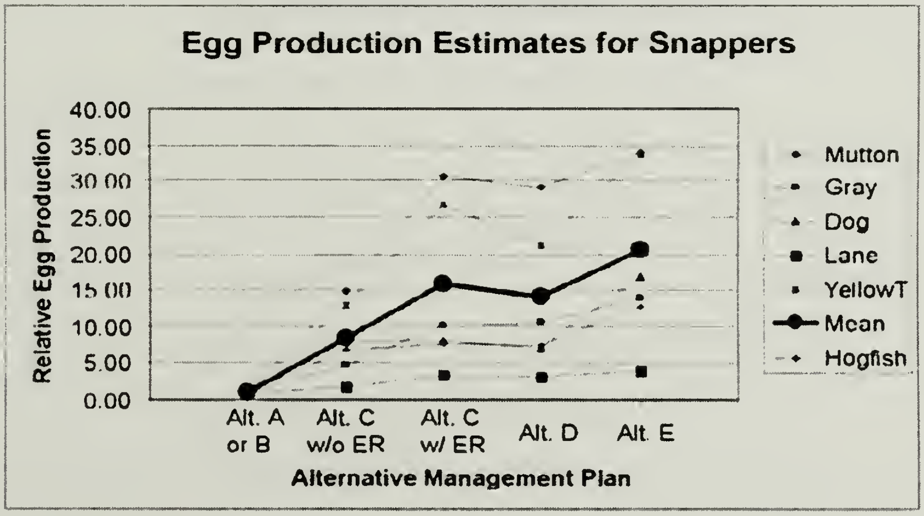


Figure B9: Results of the 20-year spatial simulations of the efficacy of the various management alternatives for all snapper.

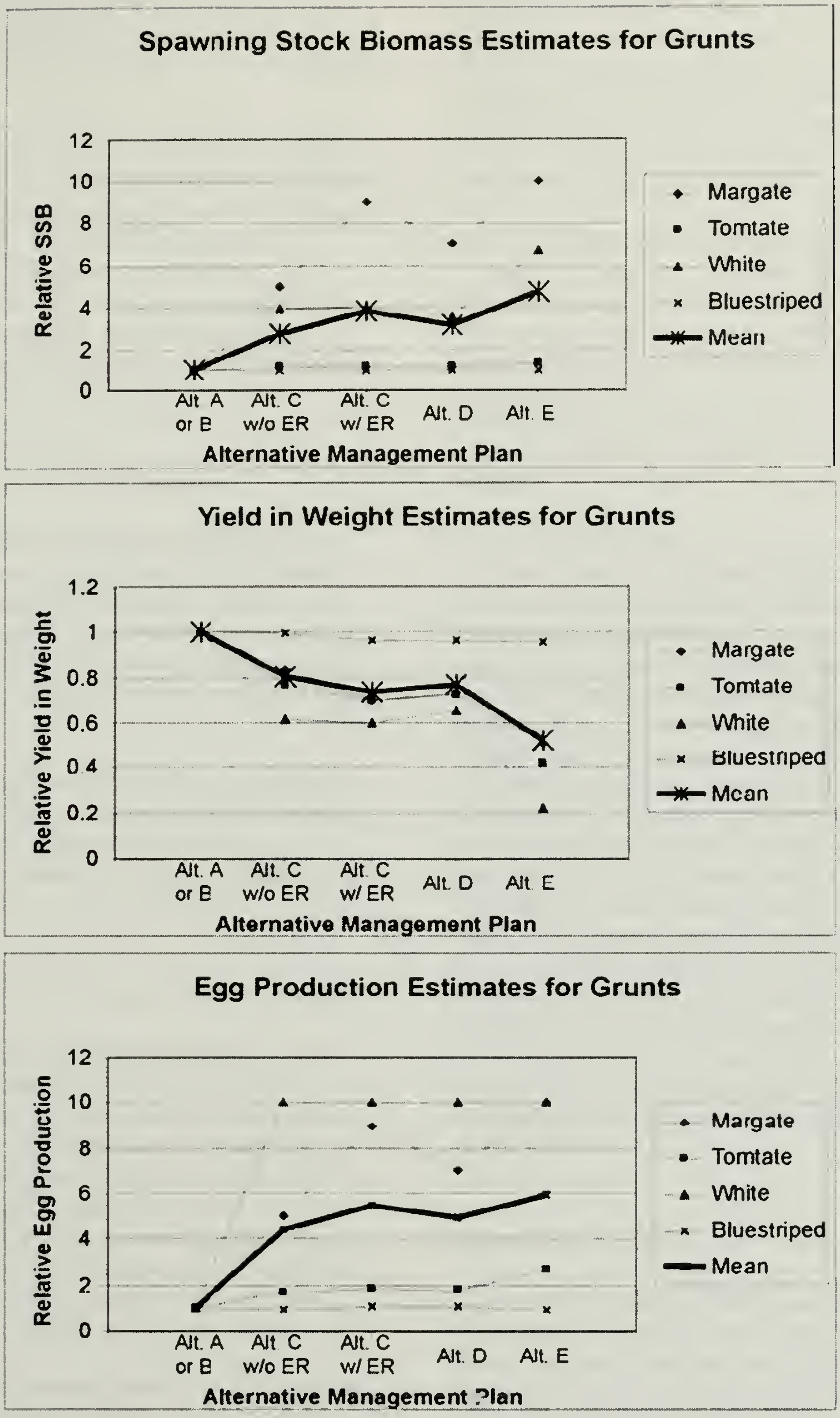


Figure B11: Results of the 20-year spatial simulations of the efficacy of the various management alternatives for all grunt species.

result in only moderate long-term risks of adverse impacts on the population due to expected fishing around the research natural area.

Other Species. The creation of the research natural area would also provide major short-term and long-term benefits to the diversity, abundance, size, and distribution of unexploited and protected/threatened fish and invertebrate populations through the protection of coral reef habitats and the elimination of accidental-catch mortality in the research natural area.

Impacts on Wildlife Resources

Birds, Turtles, and Marine Mammals. Measures to control access to land-based environments in the research natural area through guided tours under alternative C should significantly reduce short- and long-term adverse impacts on bird and turtle nests and eggs.

Eliminating fishing and restricting boat use within the research natural area zone would greatly reduce the risks to the birds, swimming turtles, and marine mammals that are caused by boating and fishing.

Impacts on the Environmental Setting

Soundscape and Night Lighting. Visitor capacity limitations within areas, the reduction of boat use, and controls on noise levels would provide a more pristine natural soundscape. Low tolerance for human activities that degrade the natural soundscape and the natural lighting of the park would decrease these impacts as would education and compliance with night sky and soundscape protection regulations.

Wetlands. Potential impacts would occur on the marine intertidal unconsolidated shore wetlands around Garden Key as a result of dock construction. The exact site of the dock is currently unknown and would be determined during the design phase. Consequently, the extent of impacts on wetlands is uncertain at this time. Appropriate environmental compliance would be conducted during site specific design of the dock facility, including analysis of impacts on wetlands.

Water Quality. In the research natural area, restricted private boat use would decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.). The restriction of any further construction of facilities, except the dock expansion, would provide increased protection of water quality.

The construction of dock facilities under this alternative might have localized impacts on the environmental resources near the fort. If a floating structure were used, the impacts should be minimized because no permanent structure would be built and pilings would not have to be driven into the ground. The construction of a permanent, shore-based structure might have short-term and long-term impacts. The potential short-term impacts would be increased sedimentation and turbidity, loss of habitat, animal mortality, air pollution, and dust dispersal. Potential long-term impacts would include loss of habitat, shading of habitat, unnatural current patterns, artificial habitat creation, sediment buildup, and interference with turtle nesting. Most of these impacts could be minimized or eliminated by careful and thoughtful construction and low-impact procedures.

Cumulative Impacts

The proposed research natural area zone in this alternative would allow the park to function as one of several reserves within a larger system of reserves proposed and operating throughout the Florida Keys National Marine Sanctuary, the Gulf of Mexico, the eastern coast of the United States, and the Caribbean, providing and receiving benefits from this system through larval, juvenile, and adult transport of species.

Conclusion

The AHP model overall results (see figure B13) indicate that alternative C would be 2.5 times more effective in achieving the park's goals with respect to natural resources than alternative A. Implementing alternative C would greatly reduce the major long-term threats posed by alternative A to the overall environmental health of the park's resources.

ALTERNATIVE D

Impacts on Essential and Unique Habitats

Coral Reefs, Sea Grass, Hardbottoms, and Sand Bottoms. The introduction of a research natural area zone in the park would significantly reduce the short- and long-term adverse impacts on coral reefs, sea grass beds, sand bottoms, and hardbottom habitats in that zone. Restrictions on private boat use in this zone would reduce the threat of major damage to underwater habitats from groundings and propellers. The elimination of anchoring and fishing in the research natural area would remove the threat of damage to underwater habitats from these activities. Limiting scuba diving, snorkeling, and swimming to deeper, localized areas near mooring buoys in the research natural area zone would significantly reduce the extent of damage to coral reefs from these activities. The research natural area zone would protect 35% of the coral reef habitats in the park, 38% of the sea grass beds, 20% of the sand bottom areas, but none of the hardbottom habitats (appendix G, table A2c). This level of research natural area protection would provide a significant increase in habitat quality compared to the no-action alternative (alternative A). The aquatic habitats outside the boundaries of the research natural area zone would still face moderate to major long-term adverse impacts due to use by boaters, fishermen, scuba divers, snorkelers, and swimmers.

Terrestrial Habitats. Monitoring and/or restricting access to much of the terrestrial habitat and using guided tours would provide increased protection for land resources compared to alternative A.

The restriction of any further construction of facilities, except dock expansion, and the shifting of visitor loads to commercial services would provide increased protection to the essential habitats of the park, further decreasing long-term adverse impacts.

Impacts on Fishery Resources

Exploited Reef Fish. Recreational fishing would not be allowed in the research natural area zone under this alternative. The placement of this zone (see map in appendix G, figure B5c) would provide greatly increased levels of protection for 80% of the reef fish species found in the park and 83% of the species in the snapper-grouper-grunt complex (appendix G, table A2c). This level of protection for a high proportion of the total species in the park would reduce the adverse impact on the reef fish community composition and provide stability to the reef fish community.

The simulation results (see appendix I) show that in 20 years, the research natural area zone would produce an 800% increase in spawning population, more than a 1,000% increase in egg production, and only a 20% drop in yield in weight for all species in the grouper complex residing in the park (see figure B7). The results for the snappers show a 280% increase in spawning population, a 1,400% increase in egg production, and a 30% decrease in yield in weight (see figure B9). Likewise, the grunts show a 350% increase in spawning population, a 500% increase in egg production, and only a 20% decrease in yield in weight (see figure B11). In addition, individual fishes would be allowed to grow to larger, naturally attainable sizes within this zone, attracting scuba divers and snorkelers. There would be major short-term and minor long-term adverse impacts on fishing yields in the park; however, fish stock size and yields would be higher and sustainable over the long term, and the presence of these substantially larger individuals would benefit recreational trophy fishing and commercial yields in water adjacent to the research natural area. Additionally, these larger individuals could leave the boundaries of the zone at times and could be caught by commercial fishermen or recreational fishermen seeking these large trophy fish.

Alternative D would provide excellent protection to the exploited reef fish stocks (groupers, snappers, and grunts) and would result in only moderate long-term adverse impacts on the reef fish populations due to expected fishing around the research natural area zone.

Other Species. The creation of the research natural area zone would also provide major short-term and long-term benefits to the diversity, abundance, size, and distribution, of unexploited and protected/threatened fish and invertebrate populations through the protection of coral reef habitats and the elimination of accidental-catch mortality within the research natural area zone.

Impacts on Wildlife Resources

Birds, Turtles, and Marine Mammals. Measures to control access to land-based environments through guided tours in the research natural area should significantly reduce short- and long-term adverse impacts on bird and turtle nests and eggs. Eliminating fishing and restricting boat use within the research natural area would greatly reduce the risks to birds, swimming turtles, and marine mammals that are caused by boating and fishing.

Impacts on the Environmental Setting

Soundscape and Night Lighting. Visitor capacity limitations within areas, the reduction of boat use, and controls on noise levels would provide a more pristine natural soundscape. Low tolerance for human activities that degrade the natural lighting of the park would improve opportunities to see the night sky.

Wetlands. Potential impacts would occur on the marine intertidal unconsolidated shore wetlands around Garden Key as a result of dock construction. The exact site of the dock is currently unknown and would be determined during the design phase. Consequently, the extent of impacts on wetlands is uncertain at this time. Appropriate environmental compliance would be conducted during site specific design of the dock facility, including analysis of impacts on wetlands.

Water Quality. In the research natural area, restricted private boat use would decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.). The restriction of any further construction of facilities, except for dock expansion, would provide increased protection of water quality.

The construction of dock facilities under this alternative might have localized impacts on the environmental resources near the fort. If a floating structure were used, the impacts should be minimized because no permanent structure would be built and pilings would not have to be driven into the ground. The construction of a permanent, shore-based structure might have short- and long-term impacts. The potential short-term impacts would be increased sedimentation and turbidity, loss of habitat, animal mortality, air pollution, and dust dispersal. Potential long-term impacts would include loss of habitat, shading of habitat, unnatural current patterns, artificial habitat creation, sediment buildup, and interference with turtle nesting.

Most of these impacts could be minimized or eliminated by careful and thoughtful construction and low-impact procedures.

Cumulative Impacts

The proposed research natural area zone in this alternative would allow the park to function as one of several reserves in a larger system of reserves proposed and operating throughout the Florida Keys National Marine Sanctuary, the Gulf of Mexico, the eastern coast of the United States, and the Caribbean, providing and receiving benefits from this system through larval, juvenile, and adult transport of species.

Conclusion

The AHP model overall results (see figure B13) indicate that alternative D would be 2.1 times more effective in achieving the park's goals with respect to natural resources than alternative A. Implementing alternative D would greatly reduce the major long-term threats posed by alternative A to the overall environmental health of the park's natural resources.

ALTERNATIVE E

Impacts on Essential and Unique Habitats

Coral Reefs, Sea Grass, Hardbottoms, and Sand Bottoms. The creation of a research natural area zone for essentially the entire park would almost eliminate the short- and long-term adverse impacts on coral reefs, sea grass beds, sand bottoms, and hardbottom habitats. Restrictions on private boat use in the park would reduce the threat of major damage to underwater habitats from groundings and propellers. The elimination of anchoring and fishing would remove the threat of damage to underwater habitats from these activities. Limiting scuba diving, snorkeling, and swimming to deeper, localized areas near mooring buoys in the research natural area zone would significantly reduce the extent of damage to coral reefs from these activities. The research natural area zone would protect nearly 100% of all underwater habitat area (appendix G, table A2b). This level of research natural area zone protection would provide a significant increase in habitat quality compared to the no-action alternative (alternative A).

Terrestrial Habitats. Monitored and/or restricted access to most of the terrestrial habitat and the use of guided tours would provide increased protection to land-based resources compared to alternative A.

The restriction of any further construction of facilities, except dock expansion, and the shifting of visitor loads to commercial services, would provide increased protection to the essential habitats of the park, further decreasing long-term adverse impacts.

Impacts on Fishery Resources

Exploited Reef Fish. Recreational fishing would not be allowed in the park (see map in appendix G, figure B5d) under this alternative, except in the historic preservation/adaptive use zone. This would protect 100% of the reef fish species in the park and thus provide stability to the community.

The simulation results (see appendix I) show that for the park and Tortugas region, in 20 years the research natural area zone would produce a 900% increase in spawning population, more than a 1000% increase in egg production, and a 50% drop in fishery yield in weight for the groupers (see figure B7). The increases in stock biomass would be reflected in larger individuals and greater stock reproductive potential. The results for the snappers show a 400% increase in spawning population, a 2,000% increase in egg production, and also a 50% decrease in yield in weight (see figure B9). Likewise, the grunts show a 500% increase in spawning population, a 600% increase in egg production, and a 50% decrease in yield in weight (figure B11). With fishing allowed only in a very limited portion of the park, fishery yields would be nearly eliminated. In addition, individuals would be allowed to grow to larger, naturally attainable sizes within the research natural area (most of the park), thereby attracting scuba divers and snorkelers. The presence of substantially larger individual fish in the park would benefit commercial fishermen and recreational trophy fishermen in waters adjacent to the park because these larger individuals could leave the boundaries of the park at times and could be caught by commercial fishermen and recreational fishermen seeking these large trophy fish.

Alternative E would provide excellent protection to the exploited reef fish populations (groupers, snappers, and grunts) and would result in only minor long-term risks of adverse impacts on those populations due to fishing around the park.

Other Species. The creation of the research natural area zone would also provide major short- and long-term benefits to the diversity, abundance, size, and distribution, of unexploited and protected/threatened fish and invertebrate populations through the protection of coral reef habitats and the elimination of accidental-catch mortality.

Impacts on Wildlife Resources

Birds, Turtles, and Marine Mammals. Measures to control access to land-based environments through guided tours under alternative E should significantly reduce short- and long-term adverse impacts on bird and turtle nests and eggs.

Eliminating fishing and restricting boat use within the research natural area (most of the park) would nearly eliminate the risks to swimming turtles, birds, and marine mammals that are caused by boating and fishing.

Impacts on the Environmental Setting

Soundscape and Night Lighting. Visitor capacity limitations within areas, the reduction of boat use, and controls on noise levels would provide a more pristine natural soundscape. Low tolerance for human activities that degrade the natural lighting of the park would improve the opportunities to see the night sky.

Wetlands. Potential impacts would occur on the marine intertidal unconsolidated shore wetlands around Garden Key as a result of dock construction. The exact site of the dock is currently unknown and would be determined during the design phase. Consequently, the extent of impacts on wetlands is uncertain at this time. Appropriate environmental compliance would be conducted during site specific design of the dock facility, including analysis of impacts on wetlands.

Water Quality. Restricted private boat use in most of the park would greatly decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.). The restriction of any further construction of facilities, except dock expansion, would provide increased protection of water quality.

The construction of dock facilities under this alternative might have localized impacts on the environmental resources near the fort. If a floating structure were used, the impacts should be minimized because no permanent structure would be built and pilings would not have to be driven into the ground. The construction of a permanent, shore-based structure might have short-term and long-term impacts. The potential short-term impacts would be increased sedimentation and turbidity, loss of habitat, animal mortality, air pollution, and dust dispersal. Potential long-term impacts would include loss of habitat, shading of habitat, unnatural current patterns, artificial habitat creation, sediment buildup, and interference with turtle nesting. Most of these impacts could be minimized or eliminated by careful and thoughtful construction and low-impact procedures.

Cumulative Impacts

The proposed research natural area zone in this alternative would allow the park to function as one of several reserves in a larger system of reserves proposed and operating throughout the Florida Keys National Marine Sanctuary, the Gulf of Mexico, the eastern coast of the United States, and the Caribbean, providing and receiving benefits from this system through larval, juvenile, and adult transport of species.

Conclusion

The AHP model overall results (see figure B13) indicate that alternative E would be 5 times more effective in achieving the park's goals with respect to natural resources than alternative A. The implementation of alternative E would almost eliminate the major long-term threats posed by alternative A to the overall environmental health of the park's natural resources.

SUMMARY AND CONCLUSION

To demonstrate the success of any management decisions within an ecosystem, it is necessary to understand both the initial state of the system and any changes that occur within the system over a given time period. It is a certainty that at some point in the future the National Park Service will be required to justify its use of a research natural area zone within the park. This will require both baseline estimates of the resources within the park and quantification of changes in those resources over time to successfully demonstrate the research natural area zone efficacy in meeting management goals. The comprehensive quantitative reef fish and habitat sampling survey conducted from late May to mid-July 1999 provides excellent baseline estimates of both the fishery resources and their critical habitats (reef, hardbottom, etc.).

Quantitative research conducted using mathematical programming, optimization, and spatial modeling techniques showed that reef fish species that were fished the most before the establishment of a research natural area zone showed the greatest recovery response to the establishment of the zone (Meester 2000). Therefore, it is important to include these species in a monitoring plan to assess the impacts of the establishment of this zone. The results of the simulation work done for this management plan, as well as the results of a retrospective assessment for the entire Florida Keys (Ault et al. 1998), indicate that serial overfishing is occurring in the Florida Keys reef fish community where the grouper species is the most intensely fished, followed by the snappers and then the grunts.

Due to the frequency of sightings from visual surveys and estimated current fishing mortality rates, it is recommended that a monitoring program minimally include the red and black groupers, the gray and yellowtail snappers, and the white grunt within the appropriate monitoring and assessment survey design. A more robust strategy would be to sample the entire reef fish community to compare effects on exploited and nonexploited community members. Changes in population numbers and sizes of individuals in the reef fish populations after the establishment of the research natural area should be particularly marked for groupers.

METHODOLOGY

The assessment of impacts on cultural resources and historic properties was made in accordance with regulations of the Advisory Council on Historic Preservation (36 CFR 800) implementing section 106 of the National Historic Preservation Act. Following a determination of the areas of potential effect, cultural resources were identified within these areas that are either listed on or are eligible for listing on the National Register of Historic Places. An assessment was made of the nature and extent of the effects on cultural resources anticipated from implementing proposed undertakings. Cultural resources can be affected by actions that alter in any way the attributes that qualify the resources for inclusion on the national register. Adverse effects can result when the integrity of a resource's significant characteristics is diminished. Consideration was given both to the effects anticipated at the same time and place of the undertaking, and to those potentially occurring indirectly and/or at a later time and distance.

To provide consistency with requirements of the National Environmental Policy Act, the effects on cultural resources are also described (in the conclusion sections for each alternative) in terminology intended to convey the duration, intensity and beneficial/negative nature of potential impacts. The intensity of impacts is defined as follows:

Negligible — The impact is barely perceptible and not measurable. Significant character-defining attributes of historic properties (including the informational potential of archeological resources) are not appreciably diminished or enhanced by the undertaking or resource protection measure.

Minor – The impact is perceptible and measurable. The effects remain localized and confined to a single element contributing to the significance of a larger national register property/district, or archeological site(s) with low to moderate data potential. Resource protection measures result in a limited degree of cultural resource preservation.

Moderate — The impact is sufficient to alter character-defining features of historic properties, generally involving a single or small group of contributing elements or archeological sites(s) with moderate to high data potential. Resource protection measures result in an adequate degree of cultural resource preservation.

Major — The impact results in a substantial and highly noticeable change in character-defining features of historic properties, generally involving a large group of contributing elements and/or individually significant property or archeological site(s) with high to exceptional data potential. Resource protection measures result in a comprehensive or substantially enhanced degree of cultural resource preservation.

REGULATIONS AND POLICIES

The National Park Service is mandated to preserve and protect its cultural resources through the Organic Act of 1916 (USC title 16) and such specific legislation as the Antiquities Act of 1906 (16 USC 431); the National Historic Preservation Act of 1966, as amended (16 USC 470); the National Environmental Policy Act of 1969, as amended (42 USC 4321, 4331, 4332); the Archeological Resources Protection Act of 1979 (16 USC 470); and the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001). In addition, the management of cultural resources is guided by the Advisory Council on Historic Preservation's implementing regulations regarding "Protection of Historic Properties"

(36 CFR 800); the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995) and *Guidelines for the Treatment of Cultural Landscapes* (1996); Chapter V of the National Park Service's *Management Policies* (1988); and the National Park Service's *Cultural Resources Management Guideline* (DO-28 1998).

As part of its cultural resource management responsibilities, the National Park Service strives to inventory and evaluate all cultural resources under its jurisdictional management. Section 110 of the National Historic Preservation Act requires that historic properties be identified and evaluated under the criteria of National Register of Historic Places eligibility. Section 110 also stipulates that historic properties be managed to preserve and protect significant values. Section 106 of the National Historic Preservation Act requires that federal agencies having direct or indirect jurisdiction over undertakings consider the effect of those undertakings on resources either listed on or eligible for listing on the National Register of Historic Places. It also requires that the Advisory Council on Historic Preservation, the state historic preservation officer, tribal representatives, and other concerned parties be provided an opportunity to comment.

ALTERNATIVE A (NO ACTION)

Analysis

Cultural resources would not be adversely affected by ongoing park undertakings, and would be protected to the greatest extent permitted under NPS policies and the availability of park staff and other NPS support personnel to carry out protection measures. Preservation actions to stabilize historic structural features at Fort Jefferson and (as necessary) at Loggerhead Key would continue to be carried out in accordance with NPS standards and guidelines and the *Secretary of the Interior's Standards for the Treatment of Historic Properties.*

There is a potential, however, that increased visitation might impact significant resources without an increase in park staff and preservation/monitoring activities. At Fort Jefferson, for example, the massive masonry walls and brick walkways are generally capable of withstanding heavy visitor use. However, at less protected areas (e.g., on top of the fort's earthen parapets along the scarp walls) increased pedestrian traffic might potentially disturb historic fabric as a result of soil erosion, perhaps leading to masonry destabilization. Preservation maintenance and stabilization activities are critical for ensuring the fort's long-term survival and structural integrity, and also to enhance visitor safety as increasing numbers of tourists tour the fort.

Expansion and rehabilitation of the Fort Jefferson visitor center into adjacent casemates would be expected to have no adverse effect on the fort's historical integrity provided that construction activities were sensitively carried out so as not to irretrievably damage or disturb historic fabric (e.g., masonry walls). More effective interpretive activities and exhibits would be accommodated by the expanded visitor center, and problems currently resulting from spalling mortar/masonry would be abated. Planned upgrade of the casemates currently used for visitor and staff quarters would also have no adverse effect on the fort's historic fabric because efficiency living-space inserts would be placed in the casemates to avoid or minimize disturbance of the existing masonry.

The growing popularity of shipwreck exploration among recreational divers also presents concerns for cultural resource protection. The park's extensive assemblage of shipwreck sites could sustain loss or impairment of valuable archeological information as divers (either intentionally or inadvertently) disturb historic fabric or remove artifacts. The park would monitor resource conditions, attempt to keep divers away from sensitive sites, and undertake other measures to reduce diver-related impacts. However, current park staffing levels are insufficient to adequately patrol shipwreck sites or to impart the importance of resource protection to visitors. Faced with increasing numbers of divers exploring wreck sites, the park would likely continue to react to incidents of resource damage rather than carry out more proactive and comprehensive resource protection measures.

Cumulative Impacts

Significant cultural resources within the park have sustained adverse effects from both natural causes (the harsh marine environment, wave and storm damage, etc.) and human impacts. Hurricanes during the last century, for example, seriously damaged lighthouses on Loggerhead and Garden Keys, and Fort Jefferson's exposed masonry continues to spall and deteriorate. Shipwreck sites face ongoing disturbance from natural processes and the impacts of recreational divers. In conjunction with increasing numbers of park visitors, a corresponding potential for further adverse effects on submerged and land-based cultural resources might be expected. However, the continuation of NPS policies and restoration undertakings would assist in protecting and preserving cultural resources to the extent permitted under current and projected funding/staffing levels. The immensity of Fort Jefferson and the unique challenges it presents for comprehensive preservation in its isolated maritime setting would continue to be a major cultural resource management issue into the future.

Conclusion

Ongoing stabilization and preservation maintenance would have moderate to major long-term benefits on Fort Jefferson, and (as necessary) the Loggerhead Key historic district. Expansion and rehabilitation of casemates for the visitor center and housing would be sensitively carried out, protecting the fort's historic fabric and structural integrity. All preservation undertakings would be carried out in accordance with NPS policies and standards and would have no adverse effect on the national register significance of historic properties.

Increased visitation, however, could result in long-term moderate to major adverse effects on cultural resources (both submerged and land-based) without a corresponding increase in the park's ability to effectively monitor and manage visitor use. The park would continue to carry out resource protection to the greatest extent permitted under existing policies, funding, and staffing levels.

ALTERNATIVE B

Analysis

This alternative would be expected to result in greater protection of cultural resources than would occur under alternative A. The park staff would be able to more effectively carry out resource protection and monitoring activities by limiting the number of visitors permitted in selected areas at a given time.

In addition to the continuation of NPS cultural resource policies and protective measures, the park would undertake more comprehensive protection for shipwreck sites under provisions of the *Submerged Cultural Resources Strategy* (see appendix J). Among its provisions, a systematic and multidisciplinary monitoring program would be implemented to assess impacts, analyze and compare changed site conditions, and provide the basis for appropriate treatment or remedial action. An effective monitoring program would have to be in place before any site was opened to recreational diving. Mooring buoys would direct divers to selected locations, and sensitive sites would remain off-limits except for approved research purposes.

Heavy visitor use would continue to be expected at Fort Jefferson, which would remain the primary destination for commercial transportation providers. The park would therefore strive to ensure that potential visitor use impacts would not compromise the fort's historic integrity or compound the deterioration occurring as a result of the harsh marine environment. The park would continue to apply stabilization measures to arrest deterioration and would, as necessary, restrict visitor access to sensitive areas that require remedial preservation treatment. No adverse effect on significant historic features would be expected from expansion and rehabilitation of the Fort Jefferson visitor center and upgrades of existing staff/visitor quarters within the fort casemates.

Additional staff would be required to adequately implement or enforce the necessary range of resource protection measures.

Cumulative Impacts

Significant cultural resources within the park have sustained adverse effects from both natural causes (the harsh marine environment, wave and storm damage, etc.) and human impacts. Hurricanes during the last century, for example, seriously damaged lighthouses on Loggerhead and Garden Keys, and Fort Jefferson's exposed masonry continues to spall and deteriorate. Shipwreck sites face ongoing disturbance from natural processes and the impacts of recreational divers. In conjunction with increasing numbers of park visitors, a corresponding potential for further adverse effects on submerged and land-based cultural resources may be expected. However, along with NPS policies for preserving and protecting cultural resources, additional measures to limit visitor numbers in certain areas of the park, and the implementation of systematic resource management approaches (e.g., the *Submerged Cultural Resources Strategy*, see appendix J) would provide positive beneficial effects that would serve to check or abate adverse effects in the future.

Although the park would be in a better position to proactively manage and protect cultural resources by implementing these measures, the immensity of Fort Jefferson and the unique challenges it presents for comprehensive preservation in its isolated maritime setting would continue to be a major cultural resource management issue.

Conclusion

Implementation of this alternative would be expected to have no adverse effect on historic properties and would provide long-term moderate benefits for preserving and protecting cultural resources. The park's ability to proactively manage cultural resources and monitor visitor use impacts would be enhanced with the adoption of the *Submerged Cultural Resources Strategy* and limitations on visitor numbers permitted in certain areas of the park.

In common with all alternatives, ongoing stabilization and preservation maintenance would have long-term moderate to major benefits on Fort Jefferson and (as necessary) the Loggerhead Key historic district. Expansion and rehabilitation of casemates for the visitor center and housing would be sensitively carried out, protecting the fort's historic fabric and structural integrity. All preservation undertakings would be carried out in accordance with NPS policies and standards and would have no adverse effect on the national register significance of historic properties.

ALTERNATIVE C

Analysis

Implementing this alternative would entail more comprehensive protection of cultural resources than would occur under alternatives A and B. In common with alternative

B, the park would be able to more effectively carry out resource protection and monitoring activities by limiting the number of visitors permitted in approved areas of the park at a given time. The establishment of a research natural area zone (intended primarily to protect critical marine habitat and ecosystems) would also have positive benefits on the cultural resources within this zone. Visitor activities would be managed to prevent or minimize resource impacts. The emphasis placed on scientific research and the retention of resources in as near-pristine condition as possible would coincide with the objectives of cultural resource preservation and archeological research.

The requirement that visitors receive a permit to enter the research natural area zone would provide an effective means of imparting the requirements for protecting cultural resources and the penalties for disturbance. This requirement would also allow the park to more closely monitor the distribution and types of visitor activities occurring in the zone, which would support cultural resource management objectives. In collaboration with the National Park Service, commercial tour operators would assume a substantial role in providing visitors with information regarding cultural resource protection. This would have positive benefits, particularly if NPS staffing levels remain inadequate to effectively impart this information to visitors.

In addition to the continuation of NPS cultural resource policies and protective measures, the park would undertake comprehensive protection of shipwreck sites under provisions of the *Submerged Cultural Resources Strategy* (see appendix J). Among its provisions, a systematic and multidisciplinary monitoring program would be implemented to assess impacts, analyze and compare changed site conditions, and provide the basis for appropriate treatment or remedial action. An effective monitoring program would have to be in place before any site was opened to recreational diving. Mooring buoys would be used to keep divers in approved locations, and sensitive sites would remain off-limits except for approved research purposes.

Heavy visitor use would continue to be expected at Fort Jefferson, which would remain the initial destination for commercial transportation providers and private boaters receiving permits. The park would therefore strive to ensure that potential visitor use impacts would not compromise the fort's historic integrity or compound the deterioration occurring as a result of the harsh marine environment. The park staff would continue to apply stabilization measures to arrest deterioration and, as necessary, restrict visitor access to sensitive areas requiring remedial preservation treatment. No adverse effect on significant historic features would be expected from expansion and rehabilitation of the Fort Jefferson visitor center and upgrades of the staff/visitor quarters within the fort casemates.

The proposed extension of the dock to accommodate concession vessel(s) would require an archeological assessment to identify potential submerged cultural resources in the area of the dock extension. If significant sites were found that could not be avoided by construction, data recovery excavations or other approved mitigation measures would be implemented before starting construction.

Cumulative Impacts

Significant cultural resources within the park have sustained adverse effects from both natural causes (the harsh marine environment, wave and storm damage, etc.) and previous human impacts. Hurricanes during the last century, for example, seriously damaged lighthouses on Loggerhead and Garden Keys, and Fort Jefferson's exposed masonry continues to spall and deteriorate. Shipwreck sites face ongoing disturbance from natural processes and the impacts of recreational divers. In conjunction with increasing numbers of park visitors, a corresponding potential for further adverse effects on submerged and land-based cultural resources might be expected. However, along with NPS policies for preserving and protecting cultural resources, additional measures to limit visitor numbers in certain areas of the park, implementation of systematic resource management approaches (e.g., the *Submerged Cultural Resources Strategy*), the establishment of a research natural area zone, and visitor permitting requirements would all provide positive beneficial effects that would serve to check or abate adverse effects in the future.

Although the park would be in a better position to proactively manage and protect cultural resources by implementing these measures, the immensity of Fort Jefferson and the unique challenges it presents for comprehensive preservation in its isolated maritime setting would continue to be a major cultural resource management issue.

Conclusion

Implementing this alternative would be expected to have no adverse effect on historic properties and would provide major long-term benefits for the preservation and protection of cultural resources. The park staff's ability to proactively manage cultural resources and monitor visitor use impacts would be substantially enhanced with the adoption of the *Submerged Cultural Resources Strategy*, limitations on visitor numbers, permitting requirements, and the adoption of a research natural area zone.

In common with all alternatives, ongoing stabilization and preservation maintenance would have long-term moderate to major benefits on Fort Jefferson and (as necessary) the Loggerhead Key historic district. Expansion and rehabilitation of casemates for the visitor center and housing would be sensitively carried out in a fashion that protects the fort's historic fabric and structural integrity. All preservation undertakings would be carried out in accordance with NPS policies and standards and would have no adverse effect on the national register significance of historic properties.

To ensure that potential archeological resources are avoided or mitigated, archeological assessments would be required for areas of construction-related disturbance associated with extension of the dock.

ALTERNATIVE D

Analysis

For the most part, the effects on cultural resources under this alternative would be the same as those described under alternative C. The elimination of private boats from the research natural area zone would be expected to incrementally increase the protection afforded to submerged cultural resources from visitor impacts. Visitor access to this zone would be solely by means of commercially operated tour vessels, and recreational diving under the direction of these operations would be closely monitored to ensure that submerged resources were adequately protected.

Requiring private boaters to get a permit to enter the natural/cultural zone would provide an effective means of imparting the requirements for protecting cultural resources and the penalties for disturbance. This requirement would also allow the park to more closely monitor the distribution and types of visitor activities occurring over a wider area of the park than under alternative C, which would benefit cultural resource management objectives. In collaboration with the National Park Service, commercial tour operators would assume a substantial role in providing visitors with information regarding cultural resource protection. This would have positive benefits, particularly if NPS staffing levels remain inadequate to effectively impart this information to visitors.

In addition to the continuation of NPS cultural resource policies and protective measures, the park staff would undertake the comprehensive protection of shipwreck sites under provisions of the *Submerged Cultural Resources Strategy* (see appendix J). Among its provisions, a systematic and multidisciplinary monitoring program would be implemented to assess impacts, analyze and compare changed site conditions, and provide the basis for appropriate treatment or remedial action. An effective monitoring program would have to be in place before any site was opened to recreational diving. Mooring buoys would be used to keep divers in approved locations, and sensitive sites would remain off-limits except for approved research purposes.

Heavy visitor use would continue to be expected at Fort Jefferson, which would remain the initial destination for commercial transportation providers and private boaters receiving permits. The park would therefore strive to ensure that potential visitor use impacts would not compromise the fort's historic integrity or compound the deterioration occurring as a result of the harsh marine environment. The park staff would continue to apply stabilization measures to arrest deterioration and, as necessary, restrict visitor access to sensitive areas that require remedial preservation treatment. No adverse effect on significant historic features would be expected from expanding and rehabilitating the Fort Jefferson visitor center and upgrades of staff/visitor quarters within the fort casemates.

The proposed extension of the dock to accommodate concession vessel(s) would require an archeological assessment to identify potential submerged cultural resources in the area of the dock extension. If significant sites were found that could not be avoided by construction, data recovery excavations, or other approved mitigation measures would be implemented before starting construction.

Cumulative Impacts

Significant cultural resources in the park have sustained adverse effects from both natural causes (the harsh marine environment, wave and storm damage, etc.) and human impacts. Hurricanes during the last century, for example, seriously damaged lighthouses on Loggerhead and Garden Keys, and Fort Jefferson's exposed masonry continues to spall and deteriorate. Shipwreck sites face ongoing disturbance from natural processes and the impacts of recreational divers. In conjunction with increasing numbers of visitors to the park, a corresponding potential for further adverse effects on submerged and land-based cultural resources might be expected. However, along with NPS policies for preserving and protecting cultural resources, additional measures to limit visitor numbers in certain areas of the park, the implementation of systematic resource management approaches (e.g., the *Submerged Cultural Resources Strategy*), the establishment of a research natural area zone, and visitor permitting requirements would all provide positive beneficial effects that would check or abate adverse effects in the future.

Although the park staff would be in a better position to proactively manage and protect cultural resources by implementing these measures, the immensity of Fort Jefferson and the unique challenges it presents for comprehensive preservation in its isolated maritime setting would continue to be a major cultural resource management issue.

Conclusion

Implementing this alternative would be expected to have no adverse effect on historic properties and would provide major long-term benefits for the preservation and protection of cultural resources. In comparison with alternative C, incrementally greater cultural resource protection would result from the elimination of private boats from the research natural area zone and the requirement that private boaters obtain permits for activities in the natural/cultural zone. The park staff's ability to proactively manage cultural resources and monitor visitor use impacts would be substantially enhanced with the adoption of the *Submerged Cultural Resources Strategy*, limitations on visitor numbers, permitting requirements, and the adoption of a research natural area zone.

In common with all alternatives, ongoing stabilization and preservation maintenance would have moderate to major long-term benefits on Fort Jefferson and (as necessary) the Loggerhead Key historic district. The expansion and rehabilitation of casemates for the visitor center and housing would be sensitively carried out, protecting the fort's historic fabric and structural integrity. All preservation undertakings would be carried out in accordance with NPS policies and standards and would have no adverse effect on the national register significance of historic properties.

To ensure that potential archeological resources are avoided or mitigated, archeological assessments would be required for areas of construction-related disturbance associated with extension of the dock.

ALTERNATIVE E

Analysis

The extension of the resource natural zone to the majority of the park would result in the greatest degree of cultural resource protection in comparison with the other alternatives. The emphasis on scientific research proposed under this alternative would support the archeological research objectives identified in the *Submerged Cultural Resources Strategy* (see appendix J). Archeologists could comprehensively analyze and investigate the park's submerged cultural resources with a substantially reduced risk that valuable site data might be lost due to visitor impacts.

The requirement that visitors receive a permit to enter the research natural area zone would provide an effective means of imparting the requirements for protecting cultural resources and the penalties for disturbance. It would also allow the park to more closely monitor the distribution and types of visitor activities occurring over a wide area of the park, which would benefit cultural resource management objectives. In collaboration with the National Park Service, commercial tour operators would assume a substantial role in providing visitors with information regarding cultural resource protection. This would have positive benefits, particularly if NPS staffing levels remain inadequate to effectively impart this information to visitors.

In addition to the continuation of NPS cultural resource policies and protective measures, the park would undertake the comprehensive protection of shipwreck sites under provisions of the *Submerged Cultural Resources Strategy*. Among its provisions, a systematic and multidisciplinary monitoring program would be implemented to assess impacts, analyze and compare changed site conditions, and provide the basis for appropriate treatment or remedial action. An effective monitoring program would have to be in place before any site was opened to recreational diving. Mooring buoys would be used to keep divers in approved locations, and sensitive sites would remain off-limits except for approved research purposes.

Heavy visitor use would continue to be expected at Fort Jefferson, which would remain the initial destination for commercial transportation providers and private boaters receiving permits. The park staff would therefore strive to ensure that potential visitor use impacts would not compromise the fort's historic integrity or compound the deterioration occurring as a result of the harsh marine environment. The park staff would continue to apply stabilization measures to arrest deterioration and, as necessary, restrict visitor access to sensitive areas requiring remedial preservation treatment. No adverse effect on significant historic features would be expected from expansion and rehabilitation of the Fort Jefferson visitor center and upgrades of the staff/visitor quarters in the fort casemates.

Cumulative Impacts

Significant cultural resources in the park have sustained adverse effects from both natural causes (the harsh marine environment, wave and storm damage, etc.) and human impacts. Hurricanes during the last century, for example, seriously damaged lighthouses on Loggerhead and Garden Keys, and Fort Jefferson's exposed masonry continues to spall and deteriorate. Shipwreck sites face ongoing disturbance from natural processes and the impacts of recreational divers. In conjunction with increasing numbers of park visitors, a corresponding potential for further adverse effects on submerged and land-based cultural resources might be expected. However, along with NPS policies for preserving and protecting cultural resources, additional measures to limit visitor numbers in certain areas of the park, the implementation of systematic resource management approaches (e.g., the *Submerged Cultural Resources Strategy*), the establishment of a research natural area zone, and visitor permitting requirements would all provide positive beneficial effects that would check or abate adverse effects in the future.

Although the park staff would be in a better position to proactively manage and protect cultural resources by implementing these measures, the immensity of Fort Jefferson and the unique challenges it presents for comprehensive preservation in its isolated maritime setting would continue to be a major cultural resource management issue.

Conclusion

Implementing this alternative would be expected to have no adverse effect on historic properties and would provide major long-term benefits for the preservation and protection of cultural resources. In comparison with the other alternatives, the greatest degree of cultural resource protection would result from the extension of the research natural area zone and visitor permitting requirements to the majority of the park. The park staff's ability to proactively manage cultural resources and monitor visitor use impacts would be substantially enhanced with the adoption of the *Submerged Cultural Resources Strategy*, limitations on visitor numbers, permitting requirements, and the adoption of a widespread research natural area zone.

In common with all alternatives, ongoing stabilization and preservation maintenance would have moderate to major long-term benefits on Fort Jefferson and (as necessary) the Loggerhead Key historic district. Expansion and rehabilitation of casemates for the visitor center and housing would be sensitively carried, protecting the fort's historic fabric and structural integrity. All preservation undertakings would be carried out in accordance with NPS policies and standards and would have no adverse effect on the national register significance of historic properties.

IMPACTS ON VISITOR EXPERIENCE

METHODOLOGY

This impact analysis evaluates four aspects of visitor experience, including diversity of visitor activities, interpretation and orientation, visitor facilities and services, and visitor experience values. Analysis is conducted in terms of how the visitor experience might vary by applying different management zones in the alternatives. Analysis is qualitative rather than quantitative because of the conceptual nature of the alternatives. Consequently, professional judgment was used to reach reasonable conclusions as to the intensity and duration of potential impacts.

Basis of Analysis

Diversity of Visitor Activities. The analysis of effects on activities is based on whether there was a complete loss, addition, expansion, or a change in access to or availability of a recreational opportunity, and how the management zones would affect group and individual opportunities.

Interpretation and Orientation. The analysis of interpretation and orientation is based on whether there would be a change in the availability of education programs resulting from management zone application or other actions.

Visitor Facilities and Services The analysis discusses impacts on access to visitor facilities and services provided by the Park Service and commercial services in relation to management zone application and other actions.

Visitor Experience Values. The impact analysis associated with visitor experience values is based on whether there would be a change in opportunities for solitude, tranquility, challenge, adventure, and freedom to travel throughout the park.

Intensity

The intensity of the impact considers whether the impact to visitor experience would be negligible, minor, moderate, or major. Negligible impacts are effects considered not detectable to the visitor and would have no discernable effect. Minor impacts are effects that would be slightly detectable but not expected to have an overall effect on the visitor experience. Moderate impacts would be clearly detectable by the visitor and could have an appreciable effect on the visitor experience. Major impacts would have a substantial and noticeable effect on the visitor experience and could permanently alter various aspects of the visitor experience.

Duration

The duration of the impact considers whether the impact would occur for a short term and be temporary in nature and associated with transitional types of activities, or if the impact would occur over a long term and have permanent effect on the visitor experience, such as no recreational fishing in the research natural area.

Type of Impact

Impacts are evaluated in terms of whether they are beneficial or adverse to visitor experience. Beneficial impacts would provide greater availability of a recreational opportunity or educational program, other services, and types of experiences. Adverse impacts would reduce access or availability to these four facets of visitor experience.

ALTERNATIVE A

Analysis

Under alternative A, the current availability and diversity of recreational opportunities would continue as managed. Activities including touring the fort, snorkeling, scuba diving, fishing, boating, swimming, camping, kayaking, and viewing wildlife would continue to be available at their current levels and locations. Access to areas of the park beyond Garden Key would continue to be primarily by private boat or expensive charters rather than by commercial ferries.

With no defined limits on numbers of visitors under the no-action alternative, some activities could become crowded and change the character of these activities, which would affect the quality of the visitor experience. For example, boating, fishing, diving, snorkeling, and swimming in high use areas could become a more social rather than solitary experience. Crowded conditions would be magnified in the campground and around the fort, especially as competition grew for facilities. Increased visitation would eventually lead to a deterioration of resources in high use areas, which would result in a corresponding decline in the quality of visitor experience. Although there would be a diverse range of activities available, increasing visitation would result in a long-term, minor adverse impact on visitor activities.

Interpretive and educational services available at Fort Jefferson and by commercial services providers en route to and at Garden Key would continue. Education opportunities for private boaters would continue to be random and limited. With no additional interpretive personnel at the fort, guided tours and special programs by park rangers would remain limited.

However, the availability and diversity of interpretation and orientation programs and visitor services would be expanded under alternative A through three actions — establishing an interagency visitor facility in Key West, expanding the visitor center at the fort, and conducting additional planning to improve interpretation and orientation. These actions would provide a wide variety of interpretive media, a broad scope of topics, and in-depth educational programs that would enhance visitors' understanding of the park's cultural and natural resources and the need for preserving them.

The Key West visitor facility would introduce Dry Tortugas to people who might not be aware of the park. For visitors without the ability to visit the park, expanded interpretation at Key West would result in the park's being accessible (programmatically) through video shows, displays, and interpretive talks in lieu of actual travel to the park. Pre-visit information would tell visitors of park conditions and inform them of limited facilities in the park and the need to be self-sustained. This information also would give travelers the opportunity to choose ahead of time from a variety of visitor activities. Alternative A would have a major long-term beneficial impact on the interpretation and orientation aspect of visitor experience.

With the exception of adding the visitor facility in Key West and expanding the visitor center in the fort, the availability and diversity of visitor facilities and services would not change from their current trends. The campground, swim beach, dingy beach, restrooms, and dock would not be expanded. Commercial ferry service would continue to provide transportation to the park. Charter boats would provide intrapark travel. There would continue to be no services at the fort to provide visitors with food or convenience items.

Currently, the park is meeting visitor demand for camping and dock space, but not all visitors have an opportunity for guided tours of the fort. Overall, park visitation would increase over existing levels, although the increase over the life of this plan is not quantifiable. It is expected that increases in visitation levels would occur primarily during the current peak periods and would largely be day users and private boaters. (Currently, limits are imposed only by the number of people commercial vessels are allowed to bring to the park and by the number of private boats the dock space and anchorage can accommodate at Garden Key.)

Without limitations on visitation numbers, the potential exists for a decrease in access to facilities and services for future visitors. Some visitors would be forced to change their plans if unable to secure a campground site, for example, and would likely need to return to the mainland. Competition for dock space and anchorage would increase for private boaters and commercial service providers. The lack of access to visitor facilities and services would have a long-term, moderate, adverse impact on the visitor experience as a result of implementing alternative A.

Under alternative A, access to the park would continue as currently managed. Private boaters and charter boats would continue to have freedom to travel throughout most of the park and participate in self-initiated experiences with few restrictions. Opportunities for solitude and tranquility, challenge, and adventure in remote, near-pristine areas of the park would remain unchanged. People coming to the park by commercial ferries would not have access to the same level of solitude and tranquility, challenge, and adventure as private boaters because they would remain limited primarily to activities on Garden Key. An increase in visitation would potentially result in increased crowding and noise, especially around Garden Key. If alternative A was implemented, continued increases in the number of visitors could result in long-term, moderate adverse impacts on visitor experience values for most of the park's visitors.

Cumulative Impacts

Coordination with the Florida Keys National Marine Sanctuary in their planning efforts and participation in the South Florida Ecosystem Restoration Task Force could provide an avenue to make visitors to the park aware of the interrelationship of lands under various jurisdictions. Visitors would have the opportunity to learn from various sources regarding the importance of the South Florida ecosystem restoration efforts in a rapidly growing and encroaching urban environment. Participation in the Coral Reef Task Force would potentially assist the Park Service in presenting information on international efforts to protect and restore coral reefs around the world. Visitors would gain a comprehensive understanding of the South Florida region and an enhanced scope of knowledge extending beyond local boundaries.

In addition, knowledge from research projects in the region and beyond would provide visitors with a broad scope of new and up-to-date information regarding natural and cultural resources. Visitors to the park also could have enhanced opportunities to learn of the variety of experiences available regionally and internationally. Information, orientation, and interpretive programs and activities, combined with similar activities in other federal, state, and local areas, would result in beneficial cumulative impacts on the overall visitor experience. The intensity and duration of the cumulative impact would depend on the number and type of actions taken to implement the above planning efforts.

Conclusion

The diversity of visitor opportunities available in the park would continue, but increases in visitation could result in changes to accessibility and affect visitor experience values. Implementing alternative A would result in minor to moderate long-term adverse impacts on these aspects of the visitor experience.

Visitors would continue to benefit from interpretive programs at Fort Jefferson and en route to the park, but NPS programs would be still be conducted on a limited basis especially in contacting private boaters. However, establishing a visitor contact facility in Key West would have major long-term beneficial impacts on the visitor experience by providing enhanced interpretation and orientation.

Completion of and implementation of an interpretive plan and a wayside exhibit plan would have major long-term benefits on the visitor experience by providing tools to foster public awareness and appreciation of the park's natural and historical features, promoting an understanding of ecological concepts and relevance of historical knowledge, and instilling a sense of stewardship towards the resources.

Visitors could benefit from enhanced interpretation and orientation resulting from NPS coordination with other planning efforts, including the Florida Keys National Marine Sanctuary and the South Florida Ecosystem Restoration Task Force.

ALTERNATIVE B

Analysis

Under alternative B, visitor activities that are currently available would remain, including boating, fishing, diving, snorkeling, camping, swimming, kayaking, picnicking, and touring the fort. The management of these activities would change somewhat in that the park would establish maximum numbers of visitors appropriate in specific areas along with desired visitor behaviors and standards for resource conditions. Mooring buoys and park staff would guide visitors to specific areas to engage in activities such as snorkeling and diving.

Establishing maximum numbers of visitors for sites would allow for an increase in visitor numbers over current levels but would distribute visitors among a number of resources. Dispersal over a broad area would reduce crowding and enhance visitor experience values by giving visitors improved opportunities for solitude, tranquility, challenge, and adventure than would occur under conditions with no restrictions. As described in alternative A, private boaters would have greater opportunities to experience these values than would commercial ferry passengers whose activities would be centered primarily at Garden Key.

Visitor facilities and services currently available would continue, and establishing limits at selected sites would maximize opportunities to access facilities such as the campground and dock. Implementing alternative B would have long-term minor beneficial impacts on visitor activities, visitor experience values, and access to facilities and services.

Some visitors might experience a feeling of intrusion and loss of privacy when park staff conduct monitoring activities. These activities would include investigating the location of a boat's anchor or observing visitors' contact with reef organisms when snorkeling or diving. Monitoring activities would have short-term minor adverse impacts on visitor experience values.

Establishing the visitor contact facility at Key West would have the same long-term major beneficial impacts as described in alternative A on the interpretation and orientation aspect of visitor experience. Visitors would be able to learn about park conditions and availability of facilities and services in advance and preplan their visit.

Cumulative Impacts

Coordination with the Florida Keys National Marine Sanctuary in their planning efforts and participation in the South Florida

Ecosystem Restoration Task Force could provide an avenue to make visitors to the park aware of the interrelationship of lands under various jurisdictions. Visitors would have the opportunity to learn from various sources regarding the importance of the South Florida ecosystem restoration efforts in a rapidly growing and encroaching urban environment. Participation in the Coral Reef Task Force would potentially assist the Park Service in presenting information on international efforts to protect and restore coral reefs around the world. Visitors would gain a comprehensive understanding of the South Florida region and an enhanced scope of knowledge extending beyond local boundaries.

In addition, knowledge from research projects in the region and beyond would provide visitors with a broad scope of new and up-to-date information regarding natural and cultural resources. Visitors to the park also could have enhanced opportunities to learn of the variety of experiences available regionally and internationally. Information, orientation, and interpretive programs and activities, combined with similar activities in other federal, state, and local areas, would result in beneficial cumulative impacts on the overall visitor experience. The intensity and duration of the cumulative impact would depend on the number and type of actions taken to implement the above planning efforts.

Conclusion

The diversity of visitor activities in the park would continue. Establishing maximum numbers of visitors at specific sites and dispersing them over a number of resources would improve opportunities for solitude, tranquility, challenge, and adventure and would reduce crowding at park facilities. These improvements would have long-term minor beneficial impacts on visitor activities, visitor experience values, and access to facilities and services. During monitoring activities, some visitors might experience a sense of intrusion resulting in a short-term minor adverse impact.

Establishing a visitor contact facility in Key West would have major long-term beneficial impacts on the visitor experience by providing enhanced interpretation and orientation.

Completion of and implementation of an interpretive plan and a wayside exhibit plan would have major long-term benefits on the visitor experience by providing tools to foster public awareness and appreciation of the park's natural and historical features, promoting an understanding of ecological concepts and relevance of historical knowledge, and instilling a sense of stewardship towards the resources.

Visitors could benefit from enhanced interpretation and orientation resulting from NPS coordination with other planning efforts, including the Florida Keys National Marine Sanctuary and the South Florida Ecosystem Restoration Task Force.

ALTERNATIVE C

Analysis

Implementing alternative C would improve the visitor experience by providing opportunities for visitors to travel in tours to areas of the park beyond Garden Key that are currently available to private boaters and charter boats only. The use of commercial services to provide travel within the park would give more visitors the opportunity to enjoy near-pristine resources, especially in the research natural area, and engage in activities such as snorkeling at coral reefs and diving to shipwrecks. Self-contained vessels would provide a level of comfort and services the park is unable to provide within the limitations of its facilities and the opportunity to stay overnight in the park.

Recreational fishing would not be permitted in the research natural area, which would decrease the diversity of visitor activities for some park visitors. However, recreational fishing would still be allowed in the historic preservation/adaptive use and natural/cultural zones. Visitors in these zones would be expected to encounter more recreational fishermen than if they were dispersed over the entire park. Implementing alternative C would have a long-term, minor adverse affect on recreational fishermen, but overall, opportunities to experience diverse activities would be enhanced resulting in long-term major beneficial impacts on the visitor experience.

In the management of visitor activities, the park would establish the maximum numbers of visitors appropriate in specific areas along with desired visitor behaviors and standards for resource conditions. Mooring buoys and park staff would guide visitors to specific areas to engage in activities such as snorkeling and diving. Establishing maximum numbers of visitors for sites would distribute visitors among a number of resources. Dispersal over a broad area would reduce crowding and enhance visitor experience values by giving visitors improved opportunities for solitude, tranquility, challenge, and adventure as opposed to conditions with no limitations.

Requiring a permit for private boaters to use the park would cause some boaters to experience a loss of freedom and feel inconvenienced, especially those who have previously traveled in the park without a permit.

Visitors on tours to areas beyond Garden Key would have a more structured experience and less freedom than private boaters. However, they would experience a level of challenge and adventure not currently available to most of the park's visitors. As a member of a small tour group, visitors would experience tranquility and solitude in the vast expanse of ocean and sky. Implementing alternative C would result in long-term moderate beneficial impacts on visitor experience values.

Some visitors might experience a feeling of intrusion and loss of privacy when park staff conduct monitoring activities. These activities would include investigating the location of a boat's anchor in the natural/cultural zone or observing visitor contact with reef organisms when snorkeling or diving. Monitoring activities would have short-term minor adverse impacts on some visitors seeking solitude.

Current visitor facilities and services would continue. Establishing limits on facilities and services and at selected sites could be an inconvenience to some visitors but would have a long-term beneficial impact on overall visitor experience. Most visitors would be able to experience the values for which the park was established better, including pristine resources, solitude, quiet, and tranquility. Instituting a reservation system for the campground would ensure that space without crowding was available for visitors when they arrive. Limiting the numbers of visitors that arrive on the ferry and seaplanes would also ensure that facilities and popular activity sites were not crowded and that park values were maintained. By limiting the trips and capacity for the seaplanes there would be less noise intrusion near the fort from takeoffs and landings. The seaplane limits would be intended to encourage fewer trips with larger capacity planes, which could result in more time in the park for air taxi visitors to participate in activities and thus enhance their experience.

Establishing the visitor contact facility at Key West would have the same long-term major beneficial impacts as described in alternative A on the interpretation and orientation aspect of visitor experience. Visitors would be able to learn about park conditions and the availability of facilities and services in advance and preplan their visit.

The impact on visitors of establishing an entrance fee would depend on the amount of the fee. However, it would not be expected to deter visitors from coming to the park. The impact of charging visitors an entrance fee would have long-term negligible to minor adverse impacts on visitor use.

Implementing alternative C would provide additional educational opportunities. Visitors in tour groups would gain knowledge incorporated into recreational activities and presented by trained commercial tour staff en route to the park, at Fort Jefferson, and on tours beyond Garden Key. Private boaters would receive information about preserving the park's resources when they obtain a permit at the fort. Information would be expected to be up-to-date as a result of research efforts by park scientists and investigators. The beneficial impacts of these interpretation and orientation aspects on the visitor experience would be long-term and major.

Cumulative Impacts

Coordination with the Florida Keys National Marine Sanctuary in their planning efforts and participation in the South Florida Ecosystem Restoration Task Force could provide an avenue to make visitors to the park aware of the interrelationship of lands under various jurisdictions. Visitors would have the opportunity to learn from various sources regarding the importance of the South Florida ecosystem restoration efforts in a rapidly growing and encroaching urban environment. Participation in the Coral Reef Task Force would potentially assist the Park Service in presenting information on international efforts to protect and restore coral reefs around the world. Visitors would gain a comprehensive understanding of the South Florida region and an enhanced scope of knowledge extending beyond local boundaries.

In addition, knowledge from research projects in the region and beyond would provide visitors with a broad scope of new and up-to-date information regarding natural and cultural resources. Visitors to the park also could have enhanced opportunities to learn of the variety of experiences available regionally and internationally. Information, orientation, and interpretive programs and activities, combined with similar activities in other federal, state, and local areas, would result in beneficial cumulative impacts on the visitor experience. The intensity and duration of the cumulative impact would depend on the number and type of actions taken to implement the above planning efforts.

Prohibiting recreational fishing in a portion of the park, in the Florida Keys National Marine Sanctuary ecological reserve, and in Tortugas South and those portions of Tortugas North that are in state waters or under the jurisdiction of the Gulf of Mexico Fishery Management Council would have short-term adverse cumulative impacts on visitor experience values. Reducing the number of areas that allow recreational fishing would result in an increase in visitors to areas permitting the activity. There would likely be fewer opportunities to experience solitude and tranquility, resulting in a lower quality experience than currently anticipated. Fishermen would potentially catch fewer fish. However, the experience would be enhanced in the future for fishermen as marine populations increase in size and number as a result of establishing zones dedicated to improving the spawning population.

Conclusion

Visitors would be able to travel to areas beyond Garden Key on commercial service vessels and experience near-pristine resources, solitude, tranquility, challenge, and adventure previously available only to private boaters and charter boats. Implementing alternative C would result in long-term moderate beneficial impacts on visitor experience values.

The diversity of activities would be reduced for some visitors by prohibiting recreational fishing in the research natural area zone. Some boaters would experience a loss of freedom with the need to obtain a permit to travel in this zone. Implementing alternative C would have a long-term, minor adverse effect on recreational fishermen and a short-term minor adverse effect on some private boaters. Overall, opportunities to experience diverse activities would be enhanced for more visitors than currently and result in long-term major beneficial impacts on this aspect of the visitor experience. Establishing limits on numbers of visitors at selected sites would have long-term minor beneficial effects on facilities and services.

Establishing a visitor contact facility in Key West, educating visitors on tours, and requiring private boaters to obtain a permit and learn about preserving the park's resources would have major long-term beneficial impacts on the visitor experience by providing enhanced interpretation and orientation.

Completion of and implementation of an interpretive plan and a wayside exhibit plan would have major long-term benefits on the visitor experience by providing tools to foster public awareness and appreciation of the park's natural and historical features, promoting an understanding of ecological concepts and relevance of historical knowledge, and instilling a sense of stewardship towards the resources.

Visitors could benefit from enhanced interpretation and orientation resulting from NPS coordination with other planning efforts, including the Florida Keys National Marine Sanctuary, the U.S. Fish and Wildlife Service, the state, the South Florida Ecosystem Restoration Task Force, and Monroe County.

There would be a decrease in areas available for recreational fishing. However, in the future fishermen would benefit from increased fish populations as a result of various planning efforts that would establish zones dedicated to improving spawning population.

ALTERNATIVE D

Implementing alternative D would improve the visitor experience by providing opportunities for visitors to travel in tours to areas of the park beyond Garden Key that currently are available to private boaters and charter boats only. The use of commercial services to provide travel within the park would give more visitors the opportunity to enjoy near-pristine resources and engage in activities such as snorkeling and diving over coral reefs and shipwrecks. Self-contained vessels would provide a level of comfort and services that the park is unable to provide within the limitations of its facilities and the opportunity to stay overnight in the park.

In alternative D, boating and recreational fishing would not be permitted in the research natural area, which would decrease the diversity of visitor activities for some park visitors. However, boating and recreational fishing would still be allowed in the historic preservation/ adaptive use and natural/cultural zones. Visitors in these zones would be expected to encounter more boaters and recreational fishermen than if they were dispersed over the entire park. Implementing alternative D would have a long-term, minor adverse affect on boaters and recreational fishermen. However, most present-day activities would still be available to a wider spectrum of visitors in a broader area of the park. In addition, these visitors would encounter resources of high integrity, especially in the research natural area. Overall, opportunities to experience diverse activities would be enhanced, resulting in long-term major beneficial impacts on the visitor experience.

In the management of visitor activities, the park would establish maximum numbers of visitors appropriate in specific areas, along with desired visitor behaviors and standards for resource conditions. Mooring buoys and park staff would guide visitors to specific areas to engage in activities such as snorkeling and diving. Establishing maximum numbers of visitors for sites would distribute visitors among a number of resources. Dispersal over a broad area would reduce crowding and enhance visitor experience values by giving visitors improved opportunities for solitude, tranquility, challenge, and adventure as opposed to conditions with no limitations.

Visitors on tours to areas beyond Garden Key would have a more structured experience and less freedom than private boaters. However, they would experience a level of challenge and adventure not currently available to most of the park's visitors. As a member of a small tour group, visitors would experience tranquility and solitude in the vast expanse of ocean and sky. Implementing alternative D would result in long-term moderate beneficial impacts on visitor experience values.

Requiring a permit for private boaters to use the park (historic preservation/adaptive use zone) and prohibiting them in the research natural area would cause some boaters to experience a loss of freedom and feel inconvenienced, especially those who have previously traveled in the park without a permit. Some visitors would experience a feeling of intrusion and loss of privacy when park staff conduct monitoring activities. These activities would include investigating the location of a boat's anchor or observing visitor contact with reef organisms when snorkeling or diving. The permit process and monitoring activities would have short-term minor adverse impacts on some visitor experience values such as freedom to travel and solitude.

Current visitor facilities and services would continue. Establishing limits on facilities and services and at selected sites could be an inconvenience to some visitors but would have a long-term beneficial impact on overall visitor experience. Most visitors would be able to experience the values for which the park was established better, including pristine resources, solitude, quiet, and tranquility. Instituting a reservation system for the campground would ensure that space without crowding was available for visitors when they arrive. Limiting the numbers of visitors that arrive on the ferry and seaplanes would also ensure that facilities and popular activity sites were not crowded and that park values were maintained. By limiting the trips and capacity for the seaplanes there would be less noise intrusion near the fort from takeoffs and landings. The seaplane limits would be intended to encourage fewer trips with larger capacity planes, which could result in more time in the park for air taxi visitors to participate in activities and thus enhance their experience.

Establishing the visitor contact facility at Key West would have the same long-term major beneficial impacts as described in alternative A on the interpretation and orientation aspect of the visitor experience. Visitors would be able to learn about park conditions and availability of facilities and services in advance and preplan their visit.

Implementing alternative D would provide additional educational opportunities. Visitors in tour groups would gain knowledge incorporated into recreational activities and presented by trained commercial tour staff en route to the park, at Fort Jefferson, and on tours beyond Garden Key. Private boaters going into the natural/cultural zone would receive information about preserving the park's resources when they obtain a permit at the fort. Interpretive information would be expected to be up-to-date as a result of research efforts by park scientists and investigators. Beneficial impacts of these interpretation and orientation aspects on the visitor experience would be long term and major.

Cumulative Impacts

Coordination with the Florida Keys National Marine Sanctuary in their planning efforts and participation in the South Florida Ecosystem Restoration Task Force could provide an avenue to make visitors to the park aware of the interrelationship of lands under various jurisdictions. Visitors would have the opportunity to learn from various sources regarding the importance of the South Florida ecosystem restoration efforts in a rapidly growing and encroaching urban environment. Participation in the Coral Reef Task Force would potentially assist the Park Service in presenting information on international efforts to protect and restore coral reefs around the world. Visitors would gain a comprehensive understanding of the South Florida region and an enhanced scope of knowledge extending beyond local boundaries.

In addition, knowledge from research projects in the region and beyond would provide visitors with a broad scope of new and up-to-date information regarding natural and cultural resources. Visitors to the park also could have enhanced opportunities to learn of the variety of experiences available regionally and internationally. Information, orientation, and interpretive programs and activities, combined with similar activities in other federal, state, and local areas, would result in beneficial cumulative impacts on the overall visitor experience. The intensity and duration of the cumulative impact would depend on the number and type of actions taken to implement the above planning efforts.

Prohibiting recreational fishing in a portion of the park, in the Florida Keys National Marine Sanctuary ecological reserve and in Tortugas South and those portions of Tortugas North that are in state waters or under the jurisdiction of the Gulf of Mexico Fishery Management Council would have short-term adverse cumulative impacts on visitor experience values. Reducing the number of areas that allow recreational fishing would result in an increase in visitors to areas permitting the activity. There likely would be fewer opportunities to experience solitude and tranquility, resulting in a lower-quality experience than currently anticipated. Fishermen would potentially catch fewer fish. However, the experience would be enhanced in the future for fishermen as marine populations increase in size and number as a result of establishing zones dedicated to improving the spawning population habitat.

Conclusion

Visitors would be able to travel to areas beyond Garden Key on commercial service vessels and experience near-pristine resources, solitude, tranquility, challenge, and adventure previously available only to private boaters and charter boats, resulting in long-term moderate beneficial impacts on visitor experience values. The diversity of activities would be reduced for some visitors by prohibiting recreational fishing and boating in the research natural area zone. Some boaters would experience a loss of freedom with the need to obtain a permit to travel in the park. Implementing alternative D would have a long-term, minor adverse effect on recreational fishermen and private boaters. Overall, opportunities to experience diverse activities would be enhanced for more visitors than currently and result in long-term major beneficial impacts on this aspect of the visitor experience. Establishing limits on numbers of visitors at selected sites would have long-term minor beneficial effects on facilities and services.

Establishing a visitor contact facility in Key West, educating visitors on tours and requiring private boaters to obtain a permit and learn about preserving the park's resources would have major long-term beneficial impacts on the visitor experience by providing enhanced interpretation and orientation.

Completion of and implementation of an interpretive plan and a wayside exhibit plan would have major long-term benefits on the visitor experience by providing tools to foster public awareness and appreciation of the park's natural and historical features, promoting an understanding of ecological concepts and relevance of historical knowledge, and instilling a sense of stewardship towards the resources.

Visitors could benefit from enhanced interpretation and orientation resulting from NPS coordination with other planning efforts, including the Florida Keys National Marine Sanctuary and the South Florida Ecosystem Restoration Task Force.

There would be a decrease in areas available for recreational fishing. However, in the future fishermen would benefit from increased fish populations as a result of various planning efforts that would establish zones dedicated to improving spawning population habitat.

ALTERNATIVE E

Implementing alternative E would improve the visitor experience by providing opportunities for visitors to travel in tours to areas of the park beyond Garden Key that currently are available to private boaters and charter boats only. The use of commercial services to provide travel within the park would give more visitors than currently are able the opportunity to enjoy near-pristine resources and engage in activities such as snorkeling and diving over coral reefs and shipwrecks. Self-contained vessels would provide a level of comfort and services the park is unable to provide within the limitations of its facilities and the opportunity to stay overnight in the park.

Private boating and recreational fishing would not be permitted in the park, which would decrease the diversity of visitor activities for park visitors. With the exception of the historic preservation/adaptive use zone, visitors wanting to engage in boating and recreational fishing activities would need to go outside of the park. Eliminating private boating and recreational fishing from the park would result in some private boaters, recreational fishermen, and charter boats seeking other areas beyond the park. It is anticipated that there would be a corresponding increase of visitors beyond the park in areas that allow these activities. There might be some minor crowding in these areas, which would result in long-term minor adverse impacts on recreational fishermen and boaters.

Implementing alternative E would have a long-term, moderate adverse affect on boaters and recreational fishermen. However, most present-day activities would still be available to a broader spectrum of visitors in a wider area of the park. In addition, these visitors would encounter resources of high integrity. There would be a significant reduction in opportunity for people to be out in the marine environment and their freedom of movement in this alternative. Because visitor experience under this alternative would be highly structured and opportunities for individual discovery or choice of activities would be limited and would fall to the prerogative of the tour operator, long-term moderate negative impact on the visitor experience would be expected.

In the management of visitor activities, the park would establish maximum numbers of visitors appropriate in specific areas, along with desired visitor behaviors and standards for resource conditions. Visitors on commercial tours would travel to specific areas to engage in activities such as snorkeling and diving. Establishing maximum numbers of visitors for sites would distribute visitors among a number of resources. Dispersal over a broad area would reduce crowding and enhance visitor experience values by giving visitors of small tour groups improved opportunities for solitude and tranquility as opposed to conditions with no limitations.

Visitors on tours to areas beyond Garden Key would have a structured experience and less freedom to travel than is currently possible. However, they would experience a level of challenge and adventure not currently available to most of the park's visitors. Implementing alternative E would result in long-term moderate beneficial impacts on visitor experience for those visitors who have very limited experience in marine areas and who rely on commercial tours (not private boats) for access.

Current visitor facilities and services would continue. Establishing limits on facilities and services and at selected sites could be an inconvenience to some visitors but would have a long-term beneficial impact on overall visitor experience. Most visitors would be able to experience the values for which the park was established better, including pristine resources, solitude, quiet, and tranquility. Instituting a reservation system for the campground would ensure that space without crowding was available for visitors when they arrive. Limiting the numbers of visitors that arrive on the ferry and seaplanes would also ensure that facilities and popular activity sites were not crowded and that park values were maintained. By limiting the trips and capacity for the seaplanes there would be less noise intrusion near the fort from takeoffs and landings. The seaplane limits would be intended to encourage fewer trips with larger capacity planes, which could result in more time in the park for air taxi visitors to participate in activities and thus enhance their experience.

Establishing the visitor contact facility at Key West would have the same long-term major beneficial impacts as described in alternative A on the interpretation and orientation aspect of visitor experience. Visitors would be able to learn about park conditions and the availability of facilities and services in advance and preplan their visit.

Implementing alternative E would provide additional educational opportunities. All visitors would be educated about sensitive resources. Visitors in tour groups would gain knowledge incorporated into recreational activities and presented by trained commercial tour staff en route to the park, at Fort Jefferson, and on tours beyond Garden Key. Interpretive information would be expected to be up-to-date as a result of research efforts by park scientists and investigators. The beneficial impacts of these interpretation and orientation aspects on the visitor experience would be long term and major.

Cumulative Impacts

Coordination with the Florida Keys National Marine Sanctuary in their planning efforts and participation in the South Florida Ecosystem Restoration Task Force could provide an avenue to make visitors to the park aware of the interrelationship of lands under various jurisdictions. Visitors would have the opportunity to learn from various sources regarding the importance of the South Florida ecosystem restoration efforts in a rapidly growing and encroaching urban environment. Participation in the Coral Reef Task Force would potentially assist the Park Service in presenting information on international efforts to protect and restore coral reefs around the world. Visitors would gain a comprehensive understanding of the South Florida region and an enhanced scope of knowledge extending beyond local boundaries.

In addition, knowledge from research projects in the region and beyond would provide visitors with a broad scope of new and up-to-date information regarding natural and cultural resources. Visitors to the park also could have enhanced opportunities to learn of the variety of experiences available regionally and internationally. Information, orientation, and interpretive programs and activities, combined with similar activities in other federal, state, and local areas, would result in beneficial cumulative impacts on the overall visitor experience. The intensity and duration of the cumulative impact would depend on the number and type of actions taken to implement the above planning efforts.

Prohibiting recreational fishing in most of the park, in the Florida Keys National Marine Sanctuary ecological reserve, and in Tortugas South and those portions of Tortugas North that are in state waters or under the jurisdiction of the Gulf of Mexico Fishery Management Council would have short-term adverse cumulative impacts on visitor experience values. Reducing the number of areas that allow recreational fishing would result in an increase in visitors to areas permitting the activity. There likely would be fewer opportunities to experience solitude and tranquility, resulting in a lower-quality experience than currently anticipated. Fishermen would potentially catch fewer fish. However, the experience would be enhanced in the future for fishermen as marine populations increase in size and number as a result of establishing zones dedicated to improving the spawning population habitat.

Conclusion

Visitors would be able to travel to areas beyond Garden Key on commercial service vessels and experience near-pristine resources, solitude, tranquility, challenge, and adventure currently available only to private boaters and charter boats, resulting in long-term moderate beneficial impacts on visitor experience values. The diversity of activities would be reduced for some visitors by prohibiting recreational fishing and boating in the park, resulting in a long-term, moderate adverse effect on recreational fishermen and private boaters. Overall, opportunities to experience diverse activities would be enhanced for more visitors than currently and result in long-term major beneficial impacts on this aspect of the visitor experience. Establishing limits on numbers of visitors at selected sites would have long-term minor beneficial effects on facilities and services.

Establishing a visitor contact facility in Key West, educating visitors on tours, and requiring private boaters obtain a permit and learn about preserving the park's resources would have major long-term beneficial impacts on the visitor experience by providing enhanced interpretation and orientation.

Completion of and implementation of an interpretive plan and a wayside exhibit plan would have major long-term benefits on the visitor experience by providing tools to foster public awareness and appreciation of the park's natural and historical features, promoting an understanding of ecological concepts and relevance of historical knowledge, and instilling a sense of stewardship towards the resources.

Visitors could benefit from enhanced interpretation and orientation resulting from NPS coordination with other planning efforts, including the Florida Keys National Marine Sanctuary and the South Florida Ecosystem Restoration Task Force.

There would be a decrease in areas available for recreational fishing. However, in the future fishermen would benefit from increased fish populations as a result of various planning efforts that would establish zones dedicated to improving spawning population.

METHODOLOGY

The impact analysis evaluated three separate socioeconomic areas including tourism and recreation, the local and regional economy, and commercial services.

Quantitative analysis of potential effects on socioeconomic conditions is not feasible due to the conceptual nature of this *General Management Plan / Environmental Impact Statement*. The analysis of effects is qualitative, and professional judgment is applied to reach reasonable conclusions as to the intensity and duration of potential impacts.

Basis of Analysis

Tourism and Recreation. The impact analysis is discussed on the basis of changes in tourism and recreational opportunities at the county and regional level associated with the implementation of each of the alternatives.

Local and Regional Economy. The analysis qualitatively analyzes impacts of potential changes in visitor spending and resultant contributions to the economy.

Commercial Services. The impact analysis qualitatively discusses the impacts of management zone application on current and potential concessioners.

Intensity

The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts were considered undetectable and would have no discernible effect on the socioeconomic environment. Minor impacts were effects on the socioeconomic environment that would be slightly detectable but not expected to have an overall effect. Moderate impacts would be clearly detectable and could have an appreciable effect. Major impacts would have a substantial influence on and could permanently alter the socioeconomic environment.

Duration

The duration of the impact considers whether the impact would occur for a short term and be temporary in nature and associated with transitional types of activities, or if the impact would occur over a long term and have a permanent effect on the socioeconomic environment.

Type of Impact

The impacts are evaluated in terms of whether the impact would be beneficial or adverse to the socioeconomic environment. Beneficial socioeconomic impacts would improve the social or economic conditions in the county or region. Adverse socioeconomic impacts would negatively alter social or economic conditions in the county or region.

ALTERNATIVE A

Analysis

The implementation of alternative A would not be expected to result in changes to overall tourism and recreational opportunities in Monroe County or the South Florida region. The region's resources, including local, state, and federal parks, would be expected to continue attracting visitors as currently experienced. Water-related activities, such as boating and fishing, and land-based opportunities, including biking and golfing, would continue to be available.

Implementing alternative A would have negligible effects on tourism overall and on the availability of recreation opportunities in Monroe County and the South Florida Region.

A continuation of trends in current economic conditions would be anticipated. Tourists and retired residents would continue to account for much of the county and region's income. The service and retail trade industries would be expected to remain in the top employment sectors of the county and regional economy.

The multiagency visitor contact facility would be expected to attract more visitors to Key West with an enhanced interpretive program of the areas' resources. Visitor spending and contributions to the economy would increase proportionally to the number of added visitors. Relative to the county and regional economic base, this increase would be anticipated to have long-term minor beneficial impacts on the economy.

Rehabilitating buildings in Key West for the visitor facility and staff housing and expanding the visitor center in the fort would have a minor short-term beneficial effect on the county's economy. The rehabilitation and expansion projects would result in additional employment opportunities in the building trades during the period of construction. Some retail businesses would have an increase in sales for purchases of supplies and equipment for construction activities. Relative to the county's employment and economic base, the economic benefit from implementing alternative A would be short-term and minor.

Transportation to and within the park would continue to be authorized by commercial use authorizations (CUAs). Basically, all commercial operators now doing business in the park, and perhaps additional operators, would continue their operations with no significant changes in income, except what would naturally occur through normal competition within the industry. Current conditions in CUA permits that limit use for carrying capacity and resource protection purposes would remain in effect or be slightly tightened, which could reduce the amount of business operators conduct in the park. Operators of large ferry-type vessels would continue to be limited to 100 passengers per day, which would have no negative impact on their current income. Interpretive materials would continue to be provided to commercial operators for voluntary use within the park. Commercial operators would not have dedicated dock space, assigned staff housing, or other assigned facilities, and they would continue to be subject to time limits at the NPS dock and other park regulations, which would have no new impacts. There would be no new impacts on commercial charter fishing operators.

Cumulative Impacts

No known cumulative impacts on tourism, recreational opportunities, or the local and regional economy would be expected.

Conclusion

Implementing alternative A would have negligible effects on tourism and the availability of recreational opportunities in Monroe County and the South Florida region. Diverse recreational activities would continue to be available. Tourism would continue to account for much of the county's income, and service and retail would remain top employment sectors.

Establishing the multiagency contact facility could attract more visitors to Key West, resulting in minor long-term benefits for the county's economy. Minor short-term economic benefits would occur as a result of rehabilitation activities for the visitor contact facility, park staff housing in Key West, and the expansion of the fort's visitor center.

Impacts on commercial operators providing ferry services to the park and charter fishing operators would be anticipated to be negligible.

ALTERNATIVE B

Analysis

As described in alternative A, implementing alternative B would not be expected to affect tourism or recreation activities in Monroe County or the South Florida region.

Current trends in contributions to the county and regional economy by tourists and retirees would likely continue. The service and retail trade industries would be expected to remain in the top employment sectors of the county and regional economy. The economic benefits of the Key West facility attracting visitors to the area would have the same long-term minor impacts on the economy as described in alternative A.

The short-term minor beneficial impacts of rehabilitating buildings for the Key West visitor contact facility and staff housing and expanding the fort's visitor center would be the same as described in alternative A.

Transportation to and within the park would continue to be authorized by commercial use authorizations. Basically, all commercial operators now doing business in the park could continue their operations with no significant changes, except what would naturally occur through normal competition within the industry. Current conditions in CUA permits that limit use for carrying capacity and resource protection purposes would remain in effect and be tightened to reflect natural/cultural zone limits, which could slightly reduce the level of commercial use in the park and consequently the income of some operators. Operators of large ferry-type vessels would continue to be limited to 100 passengers per day, which would have no adverse impact on their current income. Interpretive materials as well as training by NPS staff would continue to be available to commercial operators for voluntary use within the park, although operators would be strongly encouraged to take advantage of the opportunity. Commercial operators would not have dedicated dock space, assigned staff housing, or other assigned facilities and they would continue to be subject to time limits at the NPS dock and other park regulations, which would have no new impacts. There would be no new impacts on commercial charter fishing operators.

Cumulative Impacts

No known cumulative impacts on tourism, recreational opportunities, or the local and regional economy would be expected.

Conclusion

Implementing alternative B would have negligible effects on tourism and the availability of recreational opportunities in Monroe County and the South Florida region. Diverse recreation activities would continue to be available. Tourism would continue to account for much of the county's income, and service and retail would remain top employment sectors.

Establishing the multiagency contact facility could attract more visitors to Key West, resulting in minor long-term benefits for the county's economy. Minor short-term economic benefits would occur as a result of rehabilitation activities for the visitor contact facility, park staff housing in Key West, and the expansion of the fort's visitor center.

Limiting use for carrying capacity and resource protection purposes could slightly decrease the level of commercial use in the park, with a proportional reduction in some operators' income, especially new operators. Impacts on commercial charter fishing operators would be expected to be negligible.

ALTERNATIVE C

Analysis

Implementing alternative C would not be expected to affect tourism or recreation activities in Monroe County or the South Florida region. Eliminating recreational fishing from the research natural area zone in Dry Tortugas would likely result in some private recreational fishermen and charter boats seeking other areas within or beyond the park. However, fishermen would not be expected to discontinue this activity in the Florida Keys. It would be anticipated that implementing alternative C would have long-term negligible impacts on the county and regional tourism and recreational activities.

As in alternative A, current trends in contributions to the county and regional economy by tourists and retirees would likely continue. The service and retail trade industries would be expected to remain in the top employment sectors of the county and regional economy. The economic benefits of the Key West facility attracting visitors to the area would have the same long-term minor impacts on the economy as described in alternative A.

The short-term minor beneficial impacts of rehabilitating buildings for the Key West visitor contact facility and staff housing and expanding the fort's visitor center would be the same as described in alternative A.

Visitor use management would significantly change in this alternative, and commercial services would play an integral part in that change. Transportation to the park would be authorized by two concession contracts — one for seaplane service and another for ferry service. There would be a major beneficial economic impact for the two businesses that were awarded the contracts. Except for private boaters and multiday charters, the two concessioners would have exclusive rights to bring day use visitors to the park. Operators who currently provide those services but are not awarded one of the two concessions contracts would experience a major adverse impact. Several new job opportunities with the concessioners would be anticipated, which would add income to the local economy that would offset the lost income from current operators that do not get the contract. However, overall impacts on the regional economy would be negligible.

Instituting carrying capacity limits on the concessioners could limit potential growth in a concessioner's revenues. However, the National Park Service feels that these impacts are by far offset by the beneficial impacts on resources and visitor experience. The proposed limit for the ferry (200) would double what is currently allowed for one operator (100). Currently there are five seaplane operators authorized to bring up to 75 visitors, which is an average of 15 per operator. The proposed limit (30–40 visitors) would more than double the average for the air taxi operator who is awarded the concession contract. By limiting the number of seaplane trips per day, for visitor experience reasons, the National Park Service is trying to encourage the use of larger capacity planes, which would be a more efficient operation for the concessioner.

The ferry contract would also include a requirement to provide intrapark transportation and guided tours, within the limits of established carrying capacities in the park. This would be a new source of additional revenue for the concessioner, and it is anticipated that this income could be substantial. This would also increase the number of anticipated new job opportunities. To comply with this element of the contract (the equipment and staff to provide tours) and expansion of the dock at the fort, there would be the need for some capital investment. Some elements of the contract would be provided to the concessioner by the Park

Service, such as required interpretive and resource protection training. Other elements, such as maintaining the dock extension and operating a suitable reservation system, would be an expense for the concessioner. The Park Service has analyzed this potential contract and believes it to be economically feasible and in compliance with the law requiring that the concessioner be afforded a reasonable opportunity to make a profit.

Commercial use authorizations would authorize other appropriate commercial activities that begin and end outside the park, such as overnight sailing excursions, fishing charters, wildlife viewing, and snorkel and dive trips. There would be a minor adverse impact on most of the commercial operators that are permitted to provide those activities since the concessioner would also offer day use snorkeling and dive trips and would compete with these CUA permit holders who operate offsite, which could reduce CUA permit holders' revenues. Up to 20 charter fishing operators are permitted to make no more than 12 trips annually with a maximum of six fishermen per boat. This alternative would necessitate guide fishermen who operate within the research natural area zone to relocate to another area, either within or outside of the park. The relocation would result in an inconvenience for these operators, but the sense of inconvenience would decrease over time as guides adjust to new restrictions and guidelines. In addition, establishing the research natural area zone would be anticipated to produce economic benefits in the future resulting from a higher and sustained yield of healthier fish populations throughout the region. Adverse impacts on guide fishermen currently operating in the research natural area zone would be short term and minor.

Cumulative Impacts

Prohibiting recreational fishing in a portion of the park, in the Florida Keys National Marine Sanctuary ecological reserve, and in Tortugas South and those portions of Tortugas North that are in state waters or under the jurisdiction of the Gulf of Mexico Fishery Management Council could have adverse cumulative impacts on some businesses in the local and regional economy. Charter boat companies catering to recreational fishermen and support businesses such as fishing equipment suppliers could experience a loss of revenue.

However, loss in revenue would be expected to be short term. Protecting marine life by establishing no-fishing areas would increase the number and size of species, and these species would eventually migrate to areas outside the no-fishing zones. Dispersal of these larger and more abundant populations would likely enhance fishing throughout the region for both recreational and commercial fishermen in the future. In addition, permitting public access to minimally disturbed areas would enhance the quality and value of nonconsumptive activities such as ecotourism, photography, recreational diving, fish watching, cultural activities, and wilderness experience. The economic benefits for nonconsumptive activities would potentially offset and could exceed the current extractive value (Dixon and Sherman 1990).

Conclusion

Implementing alternative C would not be expected to affect tourism or the availability of recreational activities in the South Florida region. Current trends in contributions to the economy by retirees and tourists would continue. Although fishing would be eliminated from a portion of the park, the Florida Keys would continue to attract recreational fishermen to the area. Implementing alternative C would have negligible effects on the county and regional economies.

Establishing the multiagency contact facility could attract more visitors to Key West, resulting in minor long-term benefits to the county's economy. Minor short-term economic benefits would occur as a result of rehabilitation activities for the visitor contact facility, park staff housing in Key West, and expansion of the Fort's visitor center.

Awarding a concessions contract to one ferryboat business and one seaplane business would result in a long-term major economic benefit to the businesses receiving the contracts and a long-term major adverse impact on current operators who were not awarded a contract. Establishing intrapark transportation would provide additional revenue opportunities for the concessioner and more employment opportunities in the county. The added jobs would have a minor long-term beneficial impact on the economy. Charter fishing operators could experience a minor reduction in revenues from eliminating recreational fishing from the research natural area of the park. However, other opportunities would be available for CUA operators — such as overnight sailing excursions, fishing charters, wildlife viewing, and snorkel and dive trips.

The cumulative impacts of establishing no-fishing zones would have moderate long-term beneficial impacts on marine populations, recreational and commercial fishing, and the regional economy.

ALTERNATIVE D

Analysis

Implementing alternative D would not be expected to affect tourism or recreational activities in Monroe County or the South Florida Region. Eliminating private boating and recreational fishing from the research natural area in Dry Tortugas would likely result in some private boaters, recreational fishermen, and charter boats seeking other areas within or beyond the park. However, recreational fishermen and boaters would not be expected to discontinue these activities in the Florida Keys. It would be anticipated that implementing alternative D would have negligible impacts on the county and regional tourism and recreational activities.

As described in alternative A, current trends in contributions to the county and regional economy by tourists and retirees would likely continue. The service and retail trade industries would be expected to remain in the top employment sectors of the county and regional economy. The economic benefits of the Key West facility attracting visitors to the area would have the same long-term minor impacts on the economy as described in alternative A.

The short-term minor beneficial economic impacts of rehabilitating buildings for the Key West visitor contact facility and staff housing and expanding the fort's visitor center would be the same as described in alternative A.

The impacts of this alternative on the commercial operators and the National Park Service would be essentially the same as described in alternative C. There could be slightly more opportunities for the concessioner to increase revenues in this alternative because private boaters would not be allowed to dive, snorkel, anchor, or fish in the research natural area zone except through concessioner-guided tours.

Cumulative Impacts

Prohibiting recreational fishing in a portion of the park, in the Florida Keys National Marine Sanctuary ecological reserve, and in Tortugas South and those portions of Tortugas North that are in state waters or under the jurisdiction of the Gulf of Mexico Fishery Management Council would have adverse cumulative impacts on the local and regional economy. Charter boat companies catering to recreation fishermen and support businesses such as fishing equipment suppliers would experience a loss of revenue.

However, loss in revenue would be expected to be short term. Protecting marine life by establishing no-fishing areas would increase the number and size of species, and these species would eventually migrate to areas outside the no-fishing zones. Dispersal of these larger and more abundant populations would likely enhance fishing throughout the region for both recreational and commercial fishermen in the future. In addition, permitting public access to minimally disturbed areas would enhance the quality and value of nonconsumptive activities such as ecotourism, photography, recreational diving, fish watching, cultural activities, and wilderness experience. The economic benefits for nonconsumptive activities would potentially offset and could exceed the current extractive value (Dixon and Sherman 1990).

Conclusion

Implementing alternative D would be expected to have negligible effects on tourism and recreational activities in Monroe County and the South Florida region. Eliminating recreational fishing and private boating from a portion of the park would not be expected to discourage visitors seeking these opportunities from coming to the Florida Keys. Much of the region's revenue would be expected to continue to come from tourism and retirees.

Establishing the multiagency contact facility could attract more visitors to Key West, resulting in minor long-term benefits to the county's economy. Minor short-term economic benefits would occur as a result of rehabilitation activities for the visitor contact facility, park staff housing in Key West, and the expansion of the fort's visitor center.

Awarding a concessions contract to one ferryboat business and one seaplane business would result in a long-term major economic benefit to the businesses receiving the contracts and a long-term major adverse impact on current operators who were not awarded a contract. Establishing intrapark transportation and eliminating private boating from the research natural area would provide additional revenue for the concessioner and more employment opportunities in the county. The added jobs would have a minor long-term beneficial impact on the area's economy. Charter fishing operators could experience a minor reduction in revenues from eliminating recreational fishing from the research natural area of the park. However, other opportunities would be available for CUA operators — such as overnight sailing excursions, fishing charters, wildlife viewing, and snorkel and dive trips.

The cumulative impacts of establishing no-fishing zones would have moderate long-term beneficial impacts on marine populations, recreational and commercial fishing, and the regional economy.

ALTERNATIVE E

Analysis

Implementing alternative E would not be expected to affect tourism or recreation activities in Monroe County or the South Florida Region.

Eliminating recreational fishing and boating from the park would not be expected to result in visitors discontinuing these activities in the Florida Keys. Implementing alternative E would have a negligible impact on the county and regional tourism and economy.

As described in alternative A, current trends in contributions to the county and regional economy by tourists and retirees would likely continue. The service and retail trade industries would be expected to remain in the top employment sectors of the regional economy. The economic benefits of the Key West facility attracting visitors to the area would have the same long-term minor impacts on the economy as described in alternative A.

The short-term minor beneficial economic impacts of rehabilitating buildings for the Key West visitor contact facility and staff housing and expanding the fort's visitor center would be the same as described in alternative A.

The impacts of this alternative on the commercial operators and the National Park Service would be essentially the same as described in alternative D. However, current CUA permittees would lose opportunities and income because the concessioner would provide all commercial services in the park. As a result, there could be more opportunities for the concessioner to increase revenues, and the commercial services would be more efficient for the National Park Service to manage.

Cumulative Impacts

Prohibiting recreational fishing in the majority of the park, in the Florida Keys National Marine Sanctuary ecological reserve, and in Tortugas South and those portions of Tortugas North that are in state waters or under the jurisdiction of the Gulf of Mexico Fishery Management Council would have adverse cumulative impacts on recreational opportunities and the local and regional economy. Access to areas for recreational fishing would decrease in number and diversity. Charter boat companies catering to recreation fishermen and support businesses such as that supply fishing equipment would experience a loss of revenue. However, loss in revenue would be expected to be short term. Protecting marine life by establishing no-fishing areas would increase the number and size of species, and these species would eventually migrate to areas outside the no-fishing zones. Dispersal of these larger and more abundant populations would likely enhance fishing throughout the region for both recreational and commercial fishermen in the future. In addition, permitting public access to minimally disturbed areas would enhance the quality and value of nonconsumptive activities such as ecotourism, photography, recreational diving, fish watching, cultural activities, and wilderness experience. The economic benefits for nonconsumptive activities would potentially offset and could exceed the current extractive value (Dixon and Sherman 1990).

Conclusion

Current trends in tourism and recreation activities and contributions to the economy would be anticipated to continue. Eliminating recreational fishing and private boating from Dry Tortugas would not be expected to discourage visitors from coming to the Florida Keys to engage in these activities. Implementing alternative E would be expected to have negligible effects on the county and regional economies.

Establishing the multiagency contact facility could attract more visitors to Key West, resulting in minor long-term benefits to the county's economy. Minor short-term economic benefits would occur as a result of rehabilitation activities for the visitor contact facility, park staff housing in Key West, and the expansion of the fort's visitor center.

Awarding a concessions contract to one ferryboat business and one seaplane business would result in a long-term major economic benefit to the businesses receiving the contracts and a long-term major adverse impact on current operators who were not awarded a contract. Establishing intrapark transportation, eliminating private boating from the park, and permitting the concessioner to provide all commercial services in the park would provide additional revenue for the concessioner and more employment opportunities in the county. The added jobs would have a minor long-term beneficial impact on the area's economy. Charter fishing operators and other current holders of commercial use authorizations could experience a minor reduction in revenues from eliminating those recreational services from the park.

The cumulative impacts of establishing no-fishing areas would have moderate long-term beneficial impacts on marine populations, recreational and commercial fishing, and the regional economy.

IMPACTS ON PARK OPERATIONS AND FACILITIES

METHODOLOGY

Basis of Analysis

The impacts of the alternatives presented in this *General Management Plan Amendment / Environmental Impact Statement* and other actions on park operations and facilities were determined by examining

- the affects of changes on staffing, infrastructure, visitor facilities and services
- the role of commercial operators in providing services

Intensity

The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts were considered undetectable and would have no discernible effect on park operations and facilities. Minor impacts were effects on park operations and facilities that would be slightly detectable but not expected to have an overall effect on the ability of the park to provide services and facilities. Moderate impacts would be clearly detectable and could have an appreciable effect on park operations and facilities. Major impacts would have a substantial influence on park operations and facilities and include impacts that would reduce the park's ability to provide adequate services and facilities to visitors and staff.

Duration

The duration of the impact considers whether the impact would occur for a short term and be temporary in nature, and associated with transitional types of activities, or if the impact would occur over a long term and have a permanent effect on the socioeconomic environment.

Type of Impact

Impacts are evaluated in terms of whether the impacts on park operations and facilities would be beneficial or adverse. Beneficial impacts would improve park operations and/or facilities. Adverse impacts would negatively affect park operations and/or facilities and could hinder the park's ability to provide adequate services and facilities to visitors and staff.

ALTERNATIVE A

Analysis

Because alternative A would continue the current management strategies, there would be no change in park operations. Administration of the park would remain with Everglades National Park, and visitor protection, maintenance, and interpretation functions would remain at the fort.

Establishing a multiagency visitor facility in Key West would require the addition of one half-time visitor contact person to help staff the site. Other park operations would continue at current levels of staffing, management, and maintenance. Operations such as monitoring visitor activities would continue to be inadequate due to understaffing. Monitoring would continue to occur only as time permitted and as required by specific circumstances. A high level of patrols would be needed, but staffing levels would remain too low to contact visitors and educate them adequately about the park's resources and the need to preserve them. Because the visitor protection staff size is limited, visitor safety could continue to be compromised if several visitors with emergencies need assistance at one time. Staff safety would continue to be at risk when rangers must investigate and board unfamiliar or suspicious vessels alone.

Utility systems capacities would remain inadequate to accommodate additional personnel at one time at Garden Key. The wastewater system for the restrooms at the dock would continue to be overstressed during peak visitation periods and require frequent maintenance. The dock would continue to be too small to accommodate all the people wanting to use the park's facilities and would require staff to perform harbor master duties. The current NPS staff is severely limited in their ability to monitor commercial activities in the park, which would continue. This would cause no new impacts on commercial operators but would perpetuate a less-than-desirable management situation for park managers. Implementing alternative A would have long-term moderate adverse impacts on the maintenance of facilities and the ability of park staff to perform all necessary duties, including monitoring visitor and commercial activities.

Establishing permanent housing for park staff in Key West would improve overall park operations and living conditions for park staff who rotate to Garden Key for tours of duty in temporary housing. The installation of energy-efficient inserts into the casemates would improve comfort, health, and safety for onsite employees and research staff by eliminating water leaks and material spalling from the fort. The improvements to the visitor center would assist in protecting the exhibits and other interpretive media. These improvements would result in reduced maintenance responsibilities for park staff, improve operational efficiency, and have long-term moderate beneficial impacts on facilities and park operations.

An improved communication system would enhance visitor and staff safety, particularly in emergency situations, and aid in dispersing information to visitors — including rules, conditions, and availability of services in the park. The use of renewable energy sources would reduce fuel consumption and reduce or eliminate fuel spills, resulting in operational cost savings, as well as reducing or eliminating air and noise pollution. Providing adequate and accessible administrative office and storage space would improve staff productivity and operational efficiency.

Pre-visit information would ease the burden of limited park staff in educating visitors.

Implementing alternative A would result in long-term major beneficial impacts for park staff by improving housing units at the fort and in Key West by improving the park's communications systems, providing adequate office and storage space, using renewable energy sources, and dispensing pre-visit information to visitors.

Cumulative Impacts

No known cumulative impacts on park operations and facilities would be expected.

Conclusion

Implementing alternative A would have long-term moderate adverse impacts on park operations and facilities.

Continuing the current trend in park operations staffing would likely result in an increasing inability to meet demand for park operations, such as monitoring visitor and commercial services activities. Visitor facilities such as the dock and campground would not be able to accommodate all visitors during peak periods.

Actions in alternative A that would have long-term major beneficial impacts on park operations and facilities include installing energy-efficient inserts in the fort's casemates, improving the utilities and communications systems, providing adequate office and storage space, using renewable energy sources, and dispensing pre-visit information to visitors. These actions would relieve the workload of staff members and result in improved operational efficiency.

ALTERNATIVE B

Analysis

Park operations regarding visitor use management would be improved through enhanced education at Key West and in the park. Establishing the maximum numbers of visitors in selected areas while increasing park staff in interpretive, visitor protection, and resource management functions, along with added maintenance personnel, would distribute workloads more evenly than currently possible. This distribution would result in more efficient operations. Additional staff members would allow for a higher level of monitoring visitor activities and educating visitors about the resources and increased safety for staff and visitors. Implementing alternative B would have long-term moderate beneficial impacts on park staff and park operations.

Improving the communication system, using renewable energy sources, having adequate office and storage space, and improving housing conditions in both Key West and the park would have the same long-term benefits as alternative A.

Using mooring buoys would require a dedicated and cyclic budget (not currently available to the park) for installation and maintenance. Installations would be labor intensive and require specialized underwater tools, knowledgeable personnel, and up-to-date diving equipment. The buoy system would need frequent inspections for damage, cleaning sea growth, and replacing mooring lines. Labor and funding requirements would have long-term minor adverse impacts on park staff and operations.

More NPS staff time would be dedicated to monitoring commercial activities in the park, which would have no new impact on operators who are complying with all the conditions in their CUA permits but could have impacts on those that are not.

Charging visitors an entrance fee would be anticipated to have long-term minor beneficial impact on park revenues. The park's revenue would increase, and the additional funds could be used to improve facilities, hire additional staff, enhance interpretation and resource protection programs, improve visitor safety, and conduct research.

Cumulative Impacts

No known cumulative impacts on park operations and facilities would be expected.

Conclusion

Implementing alternative B would have long-term moderate beneficial impacts on park operations as a result of establishing visitor capacities at selected sites and an increase in staff that would improve workload distribution and allow for greater visitor education than currently possible.

Actions that would have long-term major beneficial impacts on park operations and facilities include installing energy-efficient inserts in the fort's casemates, providing adequate office and storage space, improving the communications system, using renewable energy sources, and dispensing pre-visit information to visitors. These actions would relieve the workload of staff members and result in improved operational efficiency.

Using mooring buoys would be labor intensive and require special equipment and knowledgeable personnel and a dedicated and cyclic budget. Labor and funding requirements would have long-term minor adverse impacts on park staff and operations for monitoring and maintenance of a mooring buoy system.

ALTERNATIVE C

Analysis

Park operations regarding visitor use management would be improved through enhanced education of visitors at Key West and in the park. Establishing maximum numbers of visitors in selected areas while increasing park staff in interpretive, visitor protection, resource management functions and maintenance, would distribute workloads more evenly among staff members than currently possible. This distribution would result in more efficient operations. More patrols than currently needed would be required to monitor visitor activities in and along research natural area boundaries. However, additional staff members would allow for this higher level of monitoring. In addition, there would be more time available to educate visitors, such as private boaters, about the resources and appropriate visitor behaviors. Added employees would increase safety for staff members when conducting patrols and for visitors in emergency situations.

Improving the communication system, using renewable energy sources, having adequate office and storage space, and improving housing conditions in both Key West and the park would have the same long-term benefits as alternative A.

Self-contained vessels would ease the burden on the park's limited, overstressed facilities and systems, including wastewater and freshwater systems and trash removal. It would be necessary for the commercial ferry to remain at the dock and be accessible during the entire visit. Extending the dock would ease overcrowding and provide for more efficient operations, particularly when private boaters come to Garden Key for permits.

Implementing alternative C would have long-term moderate to high adverse impacts on the need for park staff and park operations.

Using mooring buoys in the research natural area would require a dedicated and cyclic budget (not currently available to the park) for installation and maintenance. Installations would be labor intensive and require specialized underwater tools, knowledgeable personnel, and up-to-date diving equipment. The buoy system would need frequent inspections for damage, cleaning sea growth, and replacing mooring lines. Labor and funding requirements would have long-term moderate to high adverse impacts on park staff and operations for the management and maintenance of the mooring buoy system.

Authorizing the majority of commercial use in the park through concession contracts would increase the overall amount of NPS staff time required to manage the commercial services program. This would constitute a moderate to high adverse impact on park staff. Contracts contain operational, maintenance, and environmental plans that the concessioner is required to comply with. Concessioners are also required to pay a franchise fee to the government based on their gross revenues, 80% of which stay in the park to support the commercial services programs and resource protection projects. This would be a much-needed funding source as opposed to only recovering costs from commercial use authorizations. However, training the concessions staff in interpretation would require more oversight than is currently available.

Charging visitors an entrance fee would be anticipated to have long-term minor beneficial impact on park revenues. The park's revenue would increase, and the additional funds could be used to improve facilities, hire additional staff, enhance interpretation and resource protection programs, improve visitor safety, and conduct research.

Cumulative

No known cumulative impacts on park operations and facilities would be expected.

Conclusion

Implementing alternative C would have long-term major beneficial impacts on park operations as a result of establishing visitor capacities at selected sites. An increase in staff would improve workload distribution and allow for a higher level of monitoring and educating visitors than currently possible. The efficiency of operations would improve as a result of self-contained vessels easing the burden on the park's limited facilities. Extending the dock would ease crowding and enhance safety for boaters.

The structured nature of visitor use in the research natural area would require more patrols than currently needed.

Actions that would have long-term major beneficial impacts on park operations and facilities include installing energy-efficient inserts in the fort's casemates, providing adequate office and storage space, using renewable energy sources, improving the communications system, and dispensing pre-visit information to visitors. These actions would relieve the workload of staff members and result in improved operational efficiency.

Using mooring buoys would be labor intensive and require special equipment and knowledgeable personnel and a dedicated and cyclic budget. Labor and funding requirements would have long-term moderate adverse impacts on park staff and operations for the management and maintenance of a mooring buoy system.

Awarding concessions contracts would increase the overall amount of NPS staff time needed to manage and monitor the commercial services program. Concessioners would provide a funding source for the park through payment of a required franchise fee.

All aspects of this alternative would require more staff for patrols, monitoring, and training. This would constitute a long-term moderate to high adverse impact on staff requirements.

ALTERNATIVE D

Analysis

Park operations regarding visitor use management would be improved through enhanced education of visitors at Key West and in the park. Establishing maximum numbers of visitors in selected areas while increasing park staff in interpretive, visitor protection, and resource management functions, along with added maintenance personnel would distribute workloads more evenly among staff members than currently possible. This distribution would result in more efficient operations. Additional staff members would allow for a higher level of monitoring visitor activities in the natural/cultural zone. In addition, there would be more time available to educate visitors, such as private boaters, about the resources and appropriate visitor behaviors. Added employees would increase safety for staff members when conducting patrols and for visitors in emergency situations.

Improving the communication system, using renewable energy sources, having adequate office and storage space, and improving housing conditions in both Key West and the park would have the same long-term benefits as alternative A.

A higher level of patrols would be needed because of the structured and educational nature of commercial tours and the education inherent in the permit process for private boaters.

Self-contained vessels would ease the burden on the park's limited, overstressed facilities and systems, including wastewater and freshwater systems and trash removal. It would be necessary for the self-contained commercial vessels to remain at the dock and be accessible to visitors during the entire visit. Extending the dock would permit this extended stay, ease overcrowding and provide for more efficient operations, particularly when private boaters come to Garden Key for permits. Implementing alternative D would have long-term moderate to high adverse impacts on park staff and park operations.

Using mooring buoys in the research natural area would require a dedicated and cyclic budget (not currently available to the park) for installation and maintenance. Installations would be labor intensive and require specialized underwater tools, knowledgeable personnel, and up-to-date diving equipment. The buoy system would need frequent inspections for damage, cleaning sea growth, and replacing mooring lines. Labor and funding requirements would have long-term moderate to high adverse impacts on park staff and operations for the management and maintenance of the mooring buoy system.

Authorizing the majority of commercial use in the park through a concession contract would increase the overall amount of NPS staff time required to manage the commercial services program. Contracts contain operational, maintenance, and environmental plans that the concessioner is required to comply with. Concessioners are also required to pay a franchise fee to the government based on their gross revenues, 80% of which stay in the park to support the commercial services programs and resource protection projects. This would be a much-needed funding source as opposed to only recovering costs from commercial use authorizations.

Charging visitors an entrance fee would be anticipated to have long-term minor beneficial impact on park revenues. The park's revenue would increase, and the additional funds could be used to improve facilities, hire additional staff, enhance interpretation and resource protection programs, improve visitor safety, and conduct research.

Cumulative Impacts

No known cumulative impacts on park operations and facilities would be expected.

Conclusion

Implementing alternative D would have long-term moderate beneficial impacts on park operations as a result of establishing visitor capacities at selected sites and an increase in staff that would improve workload distribution and allow for a higher level of monitoring and educating visitors than currently possible. The efficiency of operations would improve as a result of self-contained vessels easing the burden of the park's limited facilities. Extending the dock would ease crowding and enhance safety for boaters.

The structured nature of visitor use in the research natural area would require more patrols than currently needed.

Actions that would have long-term major beneficial impacts on park operations and facilities include installing energy-efficient inserts in the fort's casemates, providing adequate office and storage space, improving the communications system, using renewable energy sources, and dispensing pre-visit information to visitors. These actions would relieve the workload of staff members and result in improved operational efficiency.

Using mooring buoys would be labor intensive and require special equipment and knowledgeable personnel and a dedicated and cyclic budget. Labor and funding requirements would have long-term moderate to high adverse impacts on park staff and operations for the management and maintenance of a mooring buoy system.

Awarding concessions contracts would increase the overall amount of NPS staff time needed to manage and monitor the commercial services program.

Concessioners would provide a funding source for the park through payment of a required franchise fee.

All aspects of this alternative would require more staff for patrols, monitoring, and training. This would constitute a long-term moderate to high adverse impact on staff requirements.

ALTERNATIVE E

Analysis

Park operations regarding visitor use management would be improved through enhanced education of visitors at Key West and in the park. Establishing maximum numbers of visitors in selected areas while increasing park staff over current levels in interpretive, visitor protection, and resource management functions, along with added maintenance personnel, would distribute workloads more evenly among staff members than currently possible. This distribution would result in more efficient operations.

Improving the communication system, using renewable energy sources, having adequate office and storage space, and improving housing conditions in both Key West and the park would have the same long-term benefits as alternative A.

A higher level of patrols to monitor visitor activities would be needed because of the structured and educational nature of commercial tours, but added staff would give park employees time to educate visitors about the resources and would increase safety for staff members when conducting patrols and for visitors in emergency situations.

Self-contained vessels would ease the burden on the park's limited, overstressed facilities and systems, including wastewater and freshwater systems and trash removal. It would be necessary for the self-contained commercial vessels to remain at the dock and be accessible to visitors during the entire visit. Extending the dock would permit this extended stay, ease overcrowding, lessen the potential for boats to collide, and provide for more efficient operations. Implementing alternative E would have long-term moderate beneficial impacts on park staff and park operations.

Using mooring buoys in the park would require a dedicated and cyclic budget (not currently available to the park) for installation and maintenance. Installations would be labor intensive and require specialized underwater tools, knowledgeable personnel, and up-to-date diving equipment. The buoy system would need frequent inspections for damage, cleaning sea growth, and replacing mooring lines. Labor and funding requirements would have long-term major adverse impacts on park staff and operations for the management and maintenance of a mooring buoy system.

Authorizing all commercial use in the park through a concession contract would further increase the overall amount of NPS staff time required to manage the commercial services program. Contracts contain operational, maintenance, and environmental plans that the concessioner is required to comply with. Concessioners are also required to pay a franchise fee to the government based on their gross revenues, 80% of which stay in the park to support the commercial services programs and resource protection projects. This would be a much-needed funding source as opposed to only recovering costs from commercial use authorizations.

Charging visitors an entrance fee would be anticipated to have long-term minor beneficial impact on park revenues. The park's revenue would increase, and the additional funds could be used to improve facilities, hire additional staff, enhance interpretation and resource protection programs, improve visitor safety, and conduct research.

Cumulative Impacts

No known cumulative impacts on park operations and facilities would be expected.

Conclusion

Implementing alternative E would have long-term moderate to high adverse impacts on park operations as a result of establishing visitor capacities at selected sites. An increase in staff would improve workload distribution and allow for a higher level of monitoring and educating visitors than currently possible. The efficiency of operations would improve as a result of self-contained vessels easing the burden on the park's limited facilities. Extending the dock would ease crowding and enhance safety for boaters.

The structured nature of visitor use in the park would require more patrols than currently needed.

Actions that would have long-term major beneficial impacts on park operations and facilities include installing energy-efficient inserts in the fort's casemates, providing adequate office and storage space, improving the communications system, using renewable energy sources, and dispensing pre-visit information to visitors. These actions would relieve the workload of staff members and result in improved operational efficiency.

Using mooring buoys would be labor intensive and require special equipment and knowledgeable personnel and a dedicated and cyclic budget. Labor and funding requirements would have long-term major adverse impacts on park staff and operations. Overall operational staffing costs would increase significantly for the management and maintenance of a mooring buoy system.

Awarding concession contracts would further increase the overall amount of NPS staff time needed to manage and monitor the commercial services program. Concessioners would provide a funding source for the park through payment of a required franchise fee.

UNAVOIDABLE ADVERSE EFFECTS

Unavoidable adverse impacts are those impacts that cannot be fully mitigated or avoided.

ALTERNATIVE A

There would be unavoidable moderate to major adverse impacts on natural and cultural resources under alternative A as a result of increasing visitor use pressures that, with limited resources, tax the park staff's ability to effectively carry out resource protection measures. Fishing, boating, diving, and the use of anchors would continue the current trend of harmful effects on marine life and habitat, terrestrial wildlife and water quality. Visitors diving to explore shipwreck sites might remove artifacts or disturb associated archeological resources, compromising the information value of the site. These impacts would be avoidable only if human use were not allowed in the park. Mitigation measures would be taken where possible to reduce these impacts.

An increase in visitation would have the potential to reduce access to some activities and areas such as the campground and dock during peak visitation periods. Crowding and noise would increase and change the character of the visitor experience, resulting in minor to moderate adverse impacts on the visitor experience.

ALTERNATIVE B

There would be unavoidable adverse impacts on natural and cultural resources under alternative B. Even though management activities would limit some visitor numbers and activities at specific sites, moderate to major adverse impacts would occur due to continued visitor use and taxing the park staff's workload. Limiting visitor numbers at specific sites, monitoring resources and visitors, and enhancing visitor education would increase protection of resources over current conditions, but fishing, boating, diving, and the use of anchors would continue the current trend of harmful effects on marine life and habitat, terrestrial wildlife, and water quality. Despite implementation of a management strategy to provide more comprehensive protection of submerged cultural resources, there would likely continue to be instances where shipwreck artifacts and associated archeological resources are removed or disturbed by visitors exploring these sites. These impacts would be avoidable only if human use were not allowed in the park. Mitigation measures would be taken where possible to reduce these impacts.

Concentrating visitor use at mooring buoy locations would have an unavoidable impact If impacts become unacceptable, buoys might be relocated or other management action might be taken.

In addition to the above unavoidable impacts, staff increases would require additional operational funding.

ALTERNATIVE C

Aquatic habitats outside the boundaries of the research natural area zone might face moderate to major long-term unavoidable adverse impacts. This would be due to a lack of restrictions on use by boaters, fishermen, divers, snorkelers, and swimmers.

The implementation of a management strategy to provide comprehensive protection of submerged cultural resources along with other resource protection measures (e.g., zoning) would further reduce but not entirely eliminate the risk that shipwreck artifacts and associated archeological resources might be removed or disturbed by visitors exploring these sites.

Eliminating recreational fishing from the research natural area zone would decrease the diversity of visitor activities and result in long-term minor adverse impacts on fishermen.

Operators who currently provide transportation to the park and are not awarded concessions contracts would experience a major adverse economic impact. Commercial services providers who hold commercial use authorizations could experience minor adverse impacts as a result of competing with concessioners who would be permitted to offer similar services.

Visitors on tours to areas beyond Garden Key would have a structured experience and less need for self-reliance. Previous visitors by private boats might experience a loss of freedom to travel and a loss of solitude.

Concentrating visitor use at mooring buoy locations would have an unavoidable impact If impacts become unacceptable, buoys might be relocated or other management action might be taken.

ALTERNATIVE D

Aquatic habitats outside the boundaries of the research natural area zone might face moderate to major long-term unavoidable adverse impacts due to use by boaters, fishermen, divers, snorkelers, and swimmers.

The implementation of a management strategy to provide comprehensive protection of submerged cultural resources along with other resource protection measures (e.g., zoning) would further reduce but not entirely eliminate the risk that shipwreck artifacts and associated archeological resources might be removed or disturbed by visitors exploring these sites.

Eliminating recreational fishing and private boating from the research natural area zone would decrease the diversity of activities for visitors seeking these activities in the park and result in minor long-term adverse impacts on their visitor experience.

Operators who currently provide transportation to the park and were not awarded concessions contracts would experience a major adverse economic impact. Commercial services providers who hold commercial use authorizations could experience minor adverse impacts as a result of competing with concessioners who would be permitted to offer similar services.

Visitors on tours to areas beyond Garden Key would have a structured experience and less need for self-reliance. Previous visitors by private boats might experience a loss of freedom to travel and a loss of solitude.

Concentrating visitor use at mooring buoy locations would have an unavoidable impact If impacts become unacceptable, buoys might be relocated or other management action might be taken.

ALTERNATIVE E

Implementing a management strategy to provide comprehensive protection of submerged cultural resources, along with the designation of an expanded research natural area zone, would substantially reduce but not entirely eliminate the risk that shipwreck artifacts and associated archeological resources might be removed or disturbed by visitors exploring these sites.

Eliminating recreational fishing and private boating from the research natural area zone (the major portion of the park) would decrease the diversity of activities for visitors seeking these activities and result in moderate long-term adverse impacts on their visitor experience.

Operators who currently provide transportation to the park and were not awarded concessions contracts would experience a major adverse economic impact. Commercial services providers who hold commercial use authorizations could experience minor adverse impacts as a result of competing with concessioners who would be permitted to offer similar services.

Visitors on tours to areas beyond Garden Key would have a structured experience and less need for self-reliance. Previous visitors by private boats might experience a loss of freedom to travel and a loss of solitude.

Concentrating visitor use at mooring buoy locations would have an unavoidable impact If impacts become unacceptable, buoys might be relocated or other management action might be taken.

RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

This section discusses the effects of the short-term use of resources resulting from implementing this alternative on the long-term productivity of resources.

ALTERNATIVE A

The continuation of consumptive uses and visitor activities would jeopardize the long-term productivity of the environment. Noise and human activities associated with ongoing visitor and administrative use of the park would prevent marine populations from reaching their full potential in size and population density. Noise, artificial lighting, and human activities such as fishing and boating would continue to adversely affect wildlife populations including birds, sea turtles, and sea mammals. Permitting activities such as boating, anchoring, and diving over coral and shipwrecks would continue to have deleterious effects on coral, sea grass beds, sand bottoms, hardbottom habitats, water quality, and cultural resources.

ALTERNATIVE B

Limiting visitor numbers and activities at specific sites and monitoring resources would provide greater protection of resources than alternative A. However, the continuation of consumptive uses and visitor activities would jeopardize the long-term productivity of the environment. Noise and human activities associated with ongoing visitor and administrative use of the park would prevent marine populations from reaching their full potential in size and population density. Noise, artificial lighting, and human activities such as fishing and boating also would continue to adversely affect wildlife populations including birds, sea turtles, and sea mammals. Permitting activities such as boating, anchoring, and diving over coral and shipwrecks would continue to have deleterious effects on coral, sea grass beds, sand bottoms, hardbottom habitats, water quality, and cultural resources.

ALTERNATIVE C

The relationship of the proposed action to the goals of the National Environmental Policy Act is expressed in terms of the NEPA objective to maintain and enhance the long-term productivity of the environment. The National Park Service and Dry Tortugas National Park are committed to this goal; consequently, the proposed action includes numerous elements that would enhance the long-term productivity of the environment.

Improving the management of natural and cultural resources, along with enhancing research within the park, would contribute to the long-term protection and preservation of all resources considered in the proposed action. Proposals to work cooperatively with the Florida Keys National Marine Sanctuary and other agencies' initiatives for resource and public use management would further enhance resource protection and the preservation of resources.

Establishing a research natural area zone within the park would reduce the short- and long-term adverse impacts on coral reefs, sea grass beds, sand bottoms, and hardbottom habitats within the zone. Restrictions on private boat use in the research natural area would reduce the threat of major damage to underwater (benthic) habitats from groundings and propellers. Eliminating anchoring and fishing in this zone would remove the threat of damage to underwater habitats. Limiting scuba diving, snorkeling, and swimming to deeper localized areas near mooring buoys would reduce the areal extent of damage on coral reefs. The zone would protect 41% of the coral reef habitats in the park, 100% of the hardbottom habitats, 26% of the sea grass beds, and 41% of the sand bottom areas.

Establishing the research natural area would provide major short-term and long-term benefits to the abundance and diversity of exploited and unexploited and protected/threatened fish and invertebrate populations by protecting coral reef habitats and eliminating fishing. The zone would provide increased protection for 88% of reef fish species found in the park and 97% of the species in the snapper-grouper-grunt complex, resulting in an increase in spawning population, egg production, and larger individual size.

Monitored and/or restricted access to portions of the terrestrial habitat and the use of guided tours and marked pathways would provide increased protection to land-based wildlife resources compared to alternative A. Eliminating fishing and restricting boat use in the research natural area would reduce short-term and long-term adverse impacts on bird and turtle nests and eggs. Restricted boat use would decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.).

If a permanent, shore-based design were selected for dock construction, short-term impacts would include increased sedimentation and turbidity, loss of habitat, animal mortality, air pollution, and dust dispersal. Potential long-term impacts include loss of habitat, shading of habitat, unnatural current patterns, artificial habitat creation, the buildup of sediment, and interference with turtle nesting. Most of these impacts would be minimized or eliminated by appropriate mitigation measures.

ALTERNATIVE D

Establishing a research natural area zone in the park would reduce the short- and long-term adverse impacts on coral reefs, sea grass beds, sand bottoms, and hardbottom habitats within this zone. Restrictions on private boat use in the research natural area would reduce the threat of major damage to underwater habitats from groundings and propellers. Eliminating anchoring and fishing in the zone would remove the threat of damage to underwater habitats. Limiting scuba diving, snorkeling, and swimming to deeper localized areas near mooring buoys would reduce the areal extent of damage on coral reefs. The zone would protect 35% of the coral reef habitats in the park, 38% of the sea grass beds, 20% of the sand bottom areas, and none of the hardbottom areas.

Establishing the research natural area would provide major short-term and long-term benefits for the abundance and diversity of exploited and unexploited and protected/threatened fish and invertebrate populations by protecting coral reef habitats and eliminating fishing. The zone would provide increased protection for 80% of reef fish species found in the park and 83% of the species in the snapper-grouper-grunt complex, resulting in an increase in spawning population, egg production, and larger individual size.

Monitored and/or restricted access to portions of the terrestrial habitat and the use of guided tours would provide increased protection to land-based wildlife resources compared to alternative A. Eliminating fishing and restricting boat use in the research natural area would reduce short-term and long-term adverse impacts on bird and turtle nests and eggs. Restricted boat use would decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.).

Selecting a permanent, shore-based design for dock expansion would result in short-term impacts, including increased sedimentation and turbidity, loss of habitat, animal mortality, air pollution, and dust dispersal. Potential long-term impacts include loss of habitat, shading of habitat, unnatural current patterns, artificial habitat creation, the buildup of sediment, and interference with turtle nesting. Most of these impacts would be minimized or eliminated by appropriate mitigation measures.

ALTERNATIVE E

Establishing a research natural area zone for most of the park would nearly eliminate the short- and long-term adverse impacts on coral reefs, sea grass beds, sand bottoms, and hardbottom habitats. Restrictions on private boat use in the research natural area would reduce the threat of major damage to underwater habitats from groundings and propellers. Eliminating anchoring and fishing in the zone would remove the threat of damage to underwater habitats. Limiting scuba diving, snorkeling, and swimming to deeper localized areas near mooring buoys would reduce the areal extent of damage to coral reefs. The zone would protect nearly 100% of all underwater habitat.

Establishing the research natural area would provide major short-term and long-term benefits to the abundance and diversity of exploited and unexploited and protected/threatened fish and invertebrate populations by protecting coral reef habitats and eliminating fishing. The zone would provide increased protection for 100% of reef fish species found in the park and result in an increase in spawning population, egg production, and larger individual size.

Monitored and/or restricted access to portions of the terrestrial habitat and the use of guided tours and marked pathways would provide increased protection to land-based wildlife resources compared to alternative A. Eliminating fishing and restricting boat use in the research natural area zone would reduce short-term and long-term adverse impacts on bird and turtle nests and eggs. Restricted boat use would decrease the short-term risks to water quality from fuel and oil spills due to groundings and from pollution (trash, waste disposal, etc.).

Selecting a permanent, shore-based design for dock expansion would result in short-term impacts including increased sedimentation and turbidity, loss of habitat, animal mortality, air pollution, and dust dispersal. Potential long-term impacts include loss of habitat, shading of habitat, unnatural current patterns, artificial habitat creation, the buildup of sediment, and interference with turtle nesting. Most of these impacts would be minimized or eliminated by appropriate mitigation measures.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment of resources is one that cannot be changed once it occurs except perhaps in the extreme long term; an irretrievable commitment means the resource is lost for a period of time and likely cannot be recovered or reused.

ALTERNATIVE A

Ongoing activities that result in the loss of nonresilient coral reefs, sea grass beds, sand bottoms, and hardbottom habitats would be an irreversible commitment of resources. Over time, an accumulation of adverse impacts on these habitats could result in an irreversible commitment of resources. Removing artifacts from a shipwreck or disturbing associated archeological resources would compromise the information potential of the site and result in an irreversible commitment of resources. Significant sites contain unique data that cannot often be replicated or recovered once lost or disturbed.

Limited amounts of nonrenewable resources would be used for construction projects and park operations, including energy and materials. These resources would be basically irretrievable once they were committed.

ALTERNATIVE B

Ongoing activities that result in the loss of nonresilient coral reefs, sea grass beds, sand bottoms, and hardbottom habitats would be an irreversible commitment of resources. Over time, an accumulation of adverse impacts on these habitats could result in an irreversible commitment of resources. Removing artifacts from a shipwreck or disturbing associated archeological resources would compromise the information potential of the site and result in an irreversible commitment of resources. Significant sites contain unique data that cannot often be replicated or recovered once lost or disturbed.

Limited amounts of nonrenewable resources would be used for construction projects and park operations, including energy and materials. These resources would be basically irretrievable once they were committed.

ALTERNATIVE C

Although the risks of resource impacts would be further reduced by the management actions proposed under this alternative, instances of irreversible or irretrievable commitments of natural or cultural resources might occur. For example, removing artifacts from a shipwreck or disturbing significant associated archeological resources would compromise the information potential of the site and result in an irreversible commitment of resources. Significant sites contain unique data that cannot often be replicated or recovered once lost or disturbed.

Proposed management actions would contribute to resource protection and preservation and would be expected to minimize the occurrence of irreversible or irretrievable impacts.

Limited amounts of nonrenewable resources would be used for construction projects and park operations, including energy and materials. These resources would be basically irretrievable once they were committed.

ALTERNATIVE D

Although the risks of resource impacts would be further reduced by the management actions proposed under this alternative, instances of irreversible or irretrievable commitments of natural or cultural resources might occur. For example, removing artifacts from a shipwreck or disturbing significant associated archeological resources would compromise the information potential of the site and result in an irreversible commitment of resources. Significant sites contain unique data that cannot often be replicated or recovered once lost or disturbed.

Proposed management actions would contribute to resource protection and preservation and would be expected to minimize the occurrence of irreversible or irretrievable impacts. Limited amounts of nonrenewable resources would be used for construction projects and park operations, including energy and materials. These resources would be basically irretrievable once they were committed.

ALTERNATIVE E

Although the risks of resource impacts would be substantially reduced by the management actions proposed under this alternative, instances of irreversible or irretrievable commitments of natural or cultural resources might occur. For example, removing artifacts from a shipwreck or disturbing significant associated archeological resources would compromise the information potential of the site and result in an irreversible commitment of resources. Significant sites contain unique data that cannot often be replicated or recovered once lost or disturbed.

Proposed management actions would contribute to resource protection and preservation and would be expected to minimize the occurrence of irreversible or irretrievable impacts.

Limited amounts of nonrenewable resources would be used for construction projects and park operations, including energy and materials. These resources would be basically irretrievable once they were committed.

IMPACTS ON ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

ALTERNATIVE A

Limited amounts of nonrenewable resources would be used for construction projects including rehabilitating buildings for the Key West multiagency visitor facility and park housing. This expenditure of energy would be short term and negligible and include fuel for construction vehicles, construction materials, and energy used in manufacturing materials.

ALTERNATIVE B

Limited amounts of nonrenewable resources would be used for construction projects including rehabilitating buildings for the Key West multiagency visitor facility and park housing. This expenditure of energy would be short term and negligible and include fuel for construction vehicles, construction materials, and energy used in manufacturing materials.

An increase in energy expenditure would occur with proposed additional patrols to monitor visitor use and to augment resource monitoring. Added patrols would increase boat miles traveled and fuel consumption. The number of boat trips for patrols is uncertain at this time, but fuel consumption would be expected to be minor relative to overall fuel consumption in the park. From a regional context, the increase in fuel consumption would be negligible.

ALTERNATIVE C

Limited amounts of nonrenewable resources would be used for construction projects including rehabilitating buildings for the Key West multiagency visitor facility and park housing and the dock. This expenditure of energy would be short term and negligible and include fuel for construction vehicles, construction materials, and energy used in manufacturing materials.

An increase in energy expenditure would occur with proposed additional patrols to monitor visitor use and to augment resource monitoring. Added patrols would increase boat miles traveled and fuel consumption. The number of boat trips for patrols is uncertain at this time, but fuel consumption would be expected to be minor relative to overall fuel consumption in the park. From a regional context, the increase in fuel consumption would be negligible.

ALTERNATIVE D

Limited amounts of nonrenewable resources would be used for construction projects including rehabilitation of buildings for the Key West multiagency visitor facility and park housing and the dock. This expenditure of energy would be short term and negligible and include fuel for construction vehicles, construction materials, and energy used in manufacturing materials.

An increase in energy expenditure would occur with proposed additional patrols to monitor visitor use and to augment resource monitoring. Added patrols would increase boat miles traveled and fuel consumption. The number of boat trips for patrols is uncertain at this time, but fuel consumption would be expected to be minor relative to overall fuel consumption in the park. From a regional context, the increase in fuel consumption would be negligible.

Eliminating private boating from the research natural area zone could decrease fuel consumption by private boaters who would leave their boats near the fort and take a commercial tour. In a regional context, the decrease in fuel consumption would be negligible.

ALTERNATIVE E

Limited amounts of nonrenewable resources would be used for construction projects including rehabilitating buildings for the Key West multiagency visitor facility and park housing and the dock. This expenditure of energy would be short term and negligible and include fuel for construction vehicles, construction materials, and energy used in manufacturing materials.

An increase in energy expenditure would occur with proposed additional patrols to monitor visitor use and to augment resource monitoring. Added patrols would increase boat miles traveled and fuel consumption. The number of boat trips for patrols is uncertain at this time, but fuel consumption would be expected to be minor relative to overall fuel consumption in the park. From a regional context, the increase in fuel consumption would be negligible.

Eliminating private boating from the research natural area zone could decrease fuel consumption by private boaters who would leave their boats near the fort and take a commercial tour. In a regional context, the decrease in fuel consumption would be negligible.

ENVIRONMENTAL JUSTICE POLICY

Under a policy established by the secretary of the Department of the Interior, to comply with Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"), departmental agencies should identify and evaluate, during the scoping and/or planning processes, any anticipated effects, direct or indirect, from the proposed project or action on minority and low-income populations and communities, including the equity of the distribution of the benefits and risks. If any significant impacts on minority and low-income populations and communities were identified during the scoping and/or planning processes, the environmental document should clearly evaluate and state the environmental consequences of the proposed project or action on minority and low-income populations and communities.

It was determined that none of the actions of the alternatives considered in this *Draft General Management Plan Amendment/ Environmental Impact Statement* would result in significant direct or indirect adverse effects on any minority or low-income population or community. The following information contributed to this conclusion:

- The developments and actions proposed in alternative C would not result in any identifiable adverse human health effects. Therefore, there would be no direct or indirect negative or adverse effects on any minority or low-income population or community.

- The impacts on the natural and physical environment that would result from implementing alternative C would not have significant adverse effects on any minority or low-income population or community.

- The proposed action (alternative C) would not result in any identified adverse effects that would be specific to any minority or low-income community.

- The National Park Service has had an active public participation program and has equally considered all public input from persons regardless of age, race, income status, or other socioeconomic or demographic factors.

- No minority groups in Monroe County or the south Florida region would be disproportionately affected.

- Effects on the county and regional socioeconomic environment due to implementing alternative C would be marginally beneficial and would occur over a number of years. Impacts on the socioeconomic environment would not be expected to significantly alter the physical and social structure of the county or region.

CONSULTATION AND COORDINATION

SCOPING AND OTHER PUBLIC INVOLVEMENT EFFORTS

The National Park Service completed the scoping phase through a public involvement effort, including five public meetings and a newsletter requesting comments regarding the future of the park. During the period October 27, 1998 — November 17, 1998, public meetings were held in Washington, D.C., and four Florida locations: Ft. Myers, Key West, Marathon, and Miami.

Many public comments were given at the public meetings, and approximately 200 letters and Internet messages were received in response to the newsletter. All comments given in response to the scoping process have been considered and will remain in the administrative record throughout the planning process. A summary and listing of the public comments are available to the public and can be obtained through the contact information listed below.

As a direct result of the public responses received, the environmental impact statement considers the following issues: the protection of the pristine natural marine resources including coral reefs, birds, and sea turtles; the desire to maintain qualities of remoteness and tranquility; the appropriateness of specific visitor activities in the park; the need for limits on visitation; the preservation of Fort Jefferson; the effects of fishing on fisheries resources; the desire to establish a "marine reserve"; and the limitations of the park's infrastructure in the face of increasing visitation.

A *Federal Register* notice and media announcements initiated the beginning of a formal public comment period on this draft plan. All interested agencies, groups and individuals are invited to review the document and submit comments.

Public meetings on the draft plan will be held in Washington, D.C., and five Florida locations — Homestead, Naples, St. Petersburg, Marathon, and Key West. The date, time, and location of each meeting will be announced in the *Federal Register* and through the regional/local media.

CONSULTATION

In accordance with Section IV of the 1995 programmatic agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers, certain undertakings require only internal NPS review for Section 106 purposes (see table 10). Other undertakings require standard Section 106 review in accordance with 36 CFR 800, and in those instances the National Park Service consults as necessary with the state historic preservation officer, the Advisory Council on Historic Preservation, tribal officials, and other interested parties.

TABLE 10. CULTURAL RESOURCE COMPLIANCE WITH SECTION 106

Preservation maintenance actions intended to protect and stabilize historic structures at Fort Jefferson and Loggerhead Key (exclusion IV.B.1). Rehabilitation actions limited to "retaining and preserving, protecting and maintaining, and repairing and replacing in kind materials and features, consistent with the *Secretary of the Interior's Standards for Rehabilitation* and the accompanying guidelines" (exclusion IV.B.9). Actions proposed by the *Submerged Cultural Resources Strategy* for inventorying, monitoring, researching, interpreting, and protecting submerged cultural resources (exclusion IV.B.4).	These actions are programmatically excluded from Section 106 review outside the National Park Service
Expansion/rehabilitation of the Fort Jefferson visitor center into adjacent casemates. Upgrade of the casemates currently used for staff and visitor quarters. Extension of the dock requiring archeological assessment of areas anticipated to be disturbed by construction activities (alternatives C, D, and E).	These actions are anticipated to have no adverse effect (or unknown effects) on historic properties and would require consultation with the state historic preservation office during project design development

COORDINATION

The *Draft General Management Plan Amendment / Environmental Impact Statement* has been developed pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969 (Public Law 91-190) and the Council on Environmental Quality regulations (40 CFR 1508.22). The scope of this process initially focused on commercial services and visitors. The public scoping process revealed the need to expand the scope to include an amendment to the existing management plan. The revised intent of this planning process is to prepare a comprehensive management plan that discusses protection and enhancement of the values for which Dry Tortugas was authorized as a national park. The document also includes recommendations for a commercial services and visitor. During the planning process, management alternatives have been developed that address resource protection, user capacities, commercial services, and limitations of park facilities. Through scoping and the public comment review process on the draft document, the planning process is being conducted with other federal agencies, state and local governments, and interested organizations and individuals.

LIST OF AGENCIES AND ORGANIZATIONS RECEIVING A COPY OF THIS DRAFT MANAGEMENT PLAN AMENDMENT / ENVIRONMENTAL IMPACT STATEMENT

Federal Agencies

Advisory Council on Historic Preservation, Washington, DC
Army Corps of Engineers, Jacksonville, FL
  Jacksonville District Corps of Engineers, Colonel Joe R. Miller, District Engineer
  Chief, Planning Division, James Duck, Jacksonville District
U.S. Department of the Interior
  Assistant Secretary, Fish Wildlife and Parks, Donald Barry, Washington, D.C.
  Librarian, Washington, D.C.
  Office of the Regional Solicitor, Kahlman Fallon, Atlanta, GA

Office of the Solicitor, Molly Ross, Washington, D.C.
U.S. Environmental Protection Agency
  Chief Heinz Mueller, Atlanta, GA
  South Florida Field Office, Richard Harvey, West Palm Beach, FL
National Oceanic and Atmospheric Administration (NOAA)
  OCRM-Coastal Programs Division, N/ORM3, Silver Spring, MD
  Superintendent Billy Causey, Florida Keys National Marine Sanctuary, Marathon, Key Largo, and Key West, FL
NOAA-National Marine Fisheries Service
  Southeast Fisheries Center, Bradford E. Brown, Miami, FL
National Park Service
  Jerry Belson, Regional Director, Atlanta, GA
  Warren Brown, Program Analyst, NPS, Professional Services, Washington, D.C.
  Gary Davis, Channel Islands National Park, Ventura, CA
  Maureen Finnerty, Associate Director, Operations & Education, National Park Service, Washington, D.C.
  John Ehrenhard, Manager, Southeast Archeological Center, Tallahassee, FL
  Stuart Johnson, Chief, Planning and Compliance, NPS, Southeast Region, Atlanta, GA
  Public Health Officer, NPS, Southeast Region, Atlanta, GA
  Larry Murphy, Archeologist, NPS, Intermountain Cultural Resource Center, Santa, Fe, NM
  Richard Ring, Superintendent, Everglades and Dry Tortugas National Parks, Homestead, FL
  Mike Soukup, Associate Director, Natural Resource Stewardship, Washington, D.C.
  Kate Stevenson, Associate Director, Cultural Resource Stewardship, Washington, D.C.
  Superintendent, Big Cypress National Preserve, Ochopee, FL
  Superintendent, Biscayne National Park, Homestead, FL
  Superintendent, Virgin Islands National Park, St. Thomas, VI
U.S. Fish and Wildlife Service
  Steve Forsythe, Vero Beach, FL
  Refuge Manager, National Key Deer Refuge, Big Pine Key, FL
U.S. Geological Survey
  Biological Resources Division, G. Ronnie Best, Miami, FL
  Water Resources Division, Aaron Higer, West Palm Beach, FL

U.S. House of Representatives/Senate Washington, D.C.
The Honorable Peter Deutsch, U.S. House of Representatives
The Honorable Porter Goss, U.S. House of Representatives
The Honorable Bob Graham, U.S. Senate
The Honorable Connie Mack, U.S. Senate
The Honorable E. Clay Shaw, Jr., U.S. House of Representatives
The Honorable John Tierney, U.S. House of Representatives
The Honorable C.W. Young, U.S. House of Representatives

State Agencies
Florida Fish and Wildlife Conservation Commission
  Office of Environmental Services, Mary Ann Poole, Vero Beach, FL
  Division of Marine Fisheries, Director Russell Nelson, Tallahassee, FL
Florida State Clearinghouse, Department of Community Affairs, Tallahassee, FL
Governor's Commission for the Everglades, Executive Director Bonnie Kranzer, Coral Gables, FL
Office of the Governor, Rick Smith, Tallahassee, FL
Park Manager, Bahia Honda State Park, Big Pine Key, FL
Park Manager, Ft. Zachary Taylor Historic Site, Key West, FL
Park Manager, John Pennekamp Coral Reef State Park, Key Largo, FL
South Florida Water Management District, Executive Director Frank Finch, West Palm Beach, FL

State Historic Preservation Officer, Tallahassee, FL
The Honorable Daryl L. Jones, Florida Senate, Miami, FL
The Honorable Ken Sorensen, Florida House-District 120, Tavernier, FL

Organizations

Center for Marine Conservation
  Jack Sobel, Washington, D.C.
  Florida Keys Field Office, Kim Anaston, Key West, FL
Gulf of Mexico Fishery Management Council, Wayne Swingle, Tampa, FL
Miami Group, Sierra Club, S. Miami, FL
National Audubon Society, Stuart Strahl, Miami, FL
National Parks Conservation Association
  Libby Fayad, Washington, D.C.
  Ron Tipton, Washington, D.C.
Natural Resources Conservation Service, Ron Smola, West Palm Beach, FL
Natural Resources Defense Council, Brad Sewell, New York, NY
Reef Relief, Executive Director DeeVon Quirolo, Key West, FL
South Florida Regional Planning Council, Hollywood, FL
Southwest Florida Regional Planning Council, Wayne E. Daltry, N. Ft. Myers, FL
World Wildlife Fund
  Debbie Harrison, Marathon, FL
  Everglades Coalition, Co-Chair Shannon Estenoz, Plantation, FL

City/County Agencies

City Council, Islamorada, Village of Islands, Islamorada, FL
Mayor Bonnie R. MacKenzie, Naples, FL
Mayor Shirley Freeman, Monroe County, Monroe County Commission, Key West, FL
Mayor Steve Shiver, Homestead, FL
Mayor Otis Wallace, Florida City, FL
Mayor Jimmy Weekley, Key West, FL
Monroe County Planning Dept., Marathon, FL
Reference Section, Collier County Public Library, Naples, FL
Reference Section, Homestead Branch, Miami-Dade Public Library, Homestead, FL
Reference Section, Miami-Dade Public Library, Miami, FL
Reference Section, Monroe County Public Library, Islamorada, FL
Reference Section, Monroe County Public Library, Key Largo, FL
Reference Section, Monroe County Public Library, Key West, FL
Reference Section, Monroe County Public Library, Marathon, FL
South Dade Regional Library, Miami-Dade Public Library, Miami, FL
St. Petersburg Public Library, St. Petersburg, FL

Local Businesses

Island Flying Service, Inc., Seaplanes of Key West, Inc., Mickey Frederickson, Key West, FL
Noble Air, Inc., Seaplanes of Key West, Inc., Ruebin Dunegan, Key West, FL
Sunny Days Catamarans, Sonny Eymann, Key West, FL
The Yankee Fleet, Alan G. Hill, Key West, FL

APPENDIXES

SELECTED REFERENCES AND PREPARERS

Public Law 102–525
102d Congress

TITLE II—DRY TORTUGAS NATIONAL PARK

Florida.

16 USC 410xx.

SEC. 201. ESTABLISHMENT OF DRY TORTUGAS NATIONAL PARK.

(a) IN GENERAL.—In order to preserve and protect for the education, inspiration, and enjoyment of present and future generations nationally significant natural, historic, scenic, marine, and scientific values in South Florida, there is hereby established the Dry Tortugas National Park (hereinafter in this title referred to as the "park").

(b) AREA INCLUDED.—The park shall consist of the lands, waters, and interests therein generally depicted on the map entitled "Boundary Map, Fort Jefferson National Monument", numbered 364–90,001, and dated April 1980 (which is the map referenced by section 201 of Public Law 96–287). The map shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior.

16 USC 431 note. (c) ABOLITION OF MONUMENT.—The Fort Jefferson National Monument is hereby abolished.

16 USC 410xx-1.

SEC. 202. ADMINISTRATION.

(a) IN GENERAL.—The Secretary shall administer the park in accordance with this title and with the provisions of law generally applicable to units of the national park system, including the Act entitled "An Act to establish a National Park Service, and for other purposes", approved August 25, 1916 (39 Stat. 535; 16 U.S.C. 1, 2, 3, and 4).

(b) MANAGEMENT PURPOSES.—The park shall be managed for the following purposes, among others:

(1) To protect and interpret a pristine subtropical marine ecosystem, including an intact coral reef community.

(2) To protect populations of fish and wildlife, including (but not limited to) loggerhead and green sea turtles, sooty terns, frigate birds, and numerous migratory bird species.

(3) To protect the pristine natural environment of the Dry Tortugas group of islands.

(4) To protect, stabilize, restore, and interpret Fort Jefferson, an outstanding example of nineteenth century masonry fortification.

(5) To preserve and protect submerged cultural resources.

(6) In a manner consistent with paragraphs (1) through (5), to provide opportunities for scientific research.

16 USC 410xx-2. **SEC. 203. LAND ACQUISITION AND TRANSFER OF PROPERTY.**

(a) IN GENERAL.—Within the boundaries of the park the Secretary may acquire lands and interests in land by donation or exchange. For the purposes of acquiring property by exchange with the State of Florida, the Secretary may, notwithstanding any other provision of law, exchange those Federal lands which were deleted from the park by the boundary modifications enacted by section 201 of the Act of June 28, 1980 (Public Law 96–287), and which are directly adjacent to lands owned by the State of Florida outside of the park, for lands owned by the State of Florida within the park boundary.

(b) UNITED STATES COAST GUARD LANDS.—When all or any substantial portion of lands under the administration of the United States Coast Guard located within the park boundaries, including Loggerhead Key, have been determined by the United States Coast Guard to be excess to its needs, such lands shall be transferred directly to the jurisdiction of the Secretary for the purposes of this title. The United States Coast Guard may reserve the right in such transfer to maintain and utilize the existing lighthouse on Loggerhead Key in a manner consistent with the purposes of the United States Coast Guard and the purposes of this title.

(c) ADMINISTRATIVE SITE.—The Secretary is authorized to lease or to acquire, by purchase, donation, or exchange, and to operate incidental administrative and support facilities in Key West, Florida, for park administration and to further the purposes of this title.

SEC. 204. AUTHORIZATION OF APPROPRIATIONS. 16 USC 410xx-3.

There are hereby authorized to be appropriated such sums as may be necessary to carry out the purposes of this title. Any funds available for the purposes of the monument shall be available for the purposes of the park, and authorizations of funds for the monument shall be available for the park.

APPENDIX B: COLLECTIVE MISSION AND MISSION GOALS OF THE NPS SOUTH FLORIDA UNITS

MISSION

The mission of the National Park Service, within the context of the South Florida ecosystem, is to integrate and achieve the collective purposes for which the parks and the agency were created and to promote and facilitate the Park Service partnership and technical assistance programs.

To achieve this mission, the park units will actively coordinate their plans, decisions, and operations. NPS staff will jointly participate in the South Florida Ecosystem Restoration Working Group, in the Governor's Commission for a Sustainable South Florida, and in other related ecosystem restoration efforts. The focus of this participation is in natural ecosystem management, cultural resource protection, and the promotion of public understanding and appreciation of the NPS park units as part of the South Florida ecosystem.

SIGNIFICANCE

The combined significance of the four South Florida NPS units is based on the following factors:

- All the parks depend on freshwater quality and flows that are determined by a complex regional water management system.
- The parks are adjacent to and directly affected by two of the fastest growing urban areas in the nation.
- The parks are subject to more external, adverse impacts on their ecosystems than any other units in the national park system.
- The fundamental resources of the four parks are indicators of the integrity of the South Florida ecosystem.

MISSION GOALS

The following collective South Florida park mission goals state the conditions that should exist when the goals have been attained. These statements form the basis for future park planning and management for all the parks.

I. Natural and cultural resources and associated values within the South Florida national parks are protected, restored, and maintained in good condition and are managed within the broad context of the South Florida ecosystem.

- Water is free of introduced agricultural nutrients and urban-related pollutants.
- Water levels reflect quantities resulting from natural rainfall.
- Water is distributed according to pre-engineered drainage patterns.
- The timing of water deliveries corresponds to natural cycles.
- The diversity, abundance, and behavior of native South Florida plants and animals in both terrestrial and marine environments (including coral reefs and sea grass beds) are characteristic of pre-engineered drainage conditions.
- Invasive, exotic species have been eradicated.
- Hydrology, fire, and other natural processes are managed to perpetuate a healthy, viable, and dynamic ecosystem.
- Threatened and endangered species are removed from state and federal listings due to management recovery efforts.
- Archeological, historical, and other significant cultural sites are identified, evaluated, and protected.

II. South Florida national parks contribute to knowledge about natural and cultural resources, natural ecosystem management, and associated values; decisions about ecosystem management, natural resources, and public use are based on adequate scholarly and scientific information.

- Parks are leaders in the South Florida community in developing and refining ecosystem management techniques.
- Necessary and appropriate scientific research is funded and accomplished.
- Monitoring programs designed to evaluate the effectiveness and efficiency of ongoing programs are in place.
- The parks are acknowledged as significant contributors to the knowledge and understanding of the history and prehistory of South Florida.

III. The public understands and supports the need to restore, preserve, and protect the South Florida ecosystem for this and future generations.

- South Florida parks provide opportunities for visitors to find a sense of remoteness, peace, and refuge in a place of natural beauty.
- An integrated information and education program for the South Florida parks is in place. The program is multicultural, works effectively with the mass media to convey key issues at local and national levels, and ensures that the various publics understand the environmental issues and restoration efforts occurring in the South Florida ecosystem.
- Park interpretive messages explain the differences and commonalties between the National Park Service's mission and mission goals and those used by other regional parks and agencies. Interpretive messages are objective and respectful of differing missions and management policies.
- National, state, and local officials and decision makers understand, support, and appreciate the positive value that the proper management of South Florida natural and cultural systems has on the quality of human life.
- Visitors are provided access to representative areas of the four South Florida's parks in a manner that is consistent with the protection of park resources.
- Visitors to South Florida parks are aware of the variety of experiences available, as well as those attainable in other regional parks and preserves.

IV. The economic and social benefits of the South Florida parks are recognized and play a prominent role in state, local, and private sector economic decision making.

- Local and regional economies depend on ecosystem resources, such a potable water.
- The economic impact of visitor spending on local and regional economies is clearly documented and conveyed to state, local, and private sector decision makers.
- The role and impact of NPS employee spending on the local and regional economies are clearly documented and conveyed to state, local, and private sector decision makers.

V. Strong partnerships exist among the South Florida parks and local, regional, national, and tribal governments, as well as with nongovernmental organizations, to support the restoration and protection of natural and cultural resources, along with the stewardship of the South Florida ecosystem.

- The National Park Service has an active leadership role in managing South Florida's natural ecosystem through active participation in and partnerships with the South Florida Ecosystem Restoration Working Group, the Governor's Commission for a Sustainable South Florida, and other related ecosystem restoration efforts.
- In its partnerships the National Park Service brings expertise in natural ecosystem management and in promoting public understanding and appreciation of the South Florida ecosystem.
- Federally recognized South Florida American Indian tribes and staff from the South Florida parks cooperate with mutual respect, open lines of communication, and an understanding of respective cultures.

· Federal, state, local, and tribal land use and water management agencies recognize the mutual interests and responsibilities of all levels of government to protect the South Florida ecosystem. Protection is reflected in their land use and management plans and documents.
· The four units promote and administer NPS historical and recreational assistance programs.
· Appropriate facilities are available to support park programs and partnerships.

VI. South Florida national parks are responsive, efficient, safe, accountable, and productive. They use current management practices, systems, and technologies to accomplish their collective mission.

· Management activities are outcome-based and accountable; reliable mechanisms are in place to track the progress of ongoing programs
· All park resource management programs meet professional standards; staff professionals receive training and opportunities for development within their fields.
· Equipment, staff, and expertise are shared among the parks and park partners to maximize the effective use of these resources.
· Employees have the tools to successfully accomplish their roles and functions.
· Park staffs take personal responsibility and are accountable for furthering their programs.
· Park staffs are valued for the expertise they add to their park.
· Park resource managers are connected to resource professionals in other parks, as well as to partners and associates outside the parks.

APPENDIX C: EXECUTIVE ORDER 13089 "CORAL REEF PROTECTION"

EXECUTIVE ORDER 13089

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release .... June 11, 1998

EXECUTIVE ORDER 13089

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CORAL REEF PROTECTION

By the authority vested in me as President by the Constitution and the laws of the United States of America and in furtherance of the purposes of the Clean Water Act of 1977, as amended (33 U.S.C. 1251, et seq.), Coastal Zone Management Act (16 U.S.C. 1451, et seq.), Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801, et seq.), National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321, et seq.), National Marine Sanctuaries Act, (16 U.S.C. 1431, et seq.), National Park Service Organic Act (16 U.S.C. 1, et seq.), National Wildlife Refuge System Administration Act (16 U.S.C. 668dd-ee), and other pertinent statutes, to preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment, it is hereby ordered as follows:

Section 1. Definitions. (a) "U.S. coral reef ecosystems" means those species, habitats, and other natural resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the United States (e.g., Federal, State, territorial, or commonwealth waters), including reef systems in the south Atlantic, Caribbean, Gulf of Mexico, and Pacific Ocean. (b) "U.S. Coral Reef Initiative" is an existing partnership between Federal agencies and State, territorial, commonwealth, and local governments, nongovernmental organizations, and commercial interests to design and implement additional management, education, monitoring, research, and restoration efforts to conserve coral reef ecosystems for the use and enjoyment of future generations. The existing U.S. Islands Coral Reef Initiative strategy covers approximately 95 percent of U.S. coral reef ecosystems and is a key element of the overall U.S. Coral Reef Initiative. (c) "International Coral Reef Initiative" is an existing partnership, founded by the United States in 1994, of governments, intergovernmental organizations, multilateral development banks, nongovernmental organizations, scientists, and the private sector whose purpose is to mobilize governments and other interested parties whose coordinated, vigorous, and effective actions are required to address the threats to the world's coral reefs.

Sec. 2. Policy. (a) All Federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

(b) Exceptions to this section may be allowed under terms prescribed by the heads of Federal agencies:

(1) during time of war or national emergency;

(2) when necessary for reasons of national security, as determined by the President;

(3) during emergencies posing an unacceptable threat to human health or safety or to the marine environment and admitting of no other feasible solution; or

(4) in any case that constitutes a danger to human life or a real threat to vessels, aircraft, platforms, or other man-made structures at sea, such as cases of force majeure caused by stress of weather or other act of God.

Sec. 3. Federal Agency Responsibilities. In furtherance of section 2 of this order, Federal agencies whose actions affect U.S. coral reef ecosystems, shall, subject to the availability of appropriations, provide for implementation of measures needed to research, monitor, manage, and restore affected ecosystems, including, but not limited to, measures reducing impacts from pollution, sedimentation, and fishing. To the extent not inconsistent with statutory responsibilities and procedures, these measures shall be developed in cooperation with the U.S. Coral Reef Task Force and fishery management councils and in consultation with affected States, territorial, commonwealth, tribal, and local government agencies, nongovernmental organizations, the scientific community, and commercial interests.

Sec. 4. U.S. Coral Reef Task Force. The Secretary of the Interior and the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, shall co-chair a U.S. Coral Reef Task Force ("Task Force"), whose members shall include, but not be limited to, the Administrator of the Environmental Protection Agency, the Attorney General, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Defense, the Secretary of State, the Secretary of Transportation, the Director of the National Science Foundation, the Administrator of the Agency for International Development, and the Administrator of the National Aeronautics and Space Administration. The Task Force shall oversee implementation of the policy and Federal agency responsibilities set forth in this order, and shall guide and support activities under the U.S. Coral Reef Initiative ("CRI"). All Federal agencies whose actions may affect U.S. coral reef ecosystems shall review their participation in the CRI and the strategies developed under it, including strategies and plans of State, territorial, commonwealth, and local governments, and, to the extent feasible, shall enhance Federal participation and support of such strategies and plans. The Task Force shall work in cooperation with State, territorial, commonwealth, and local government agencies, nongovernmental organizations, the scientific community, and commercial interests.

Sec. 5. Duties of the U.S. Coral Reef Task Force. (a) Coral Reef Mapping and

Monitoring. The Task Force, in cooperation with State, territory, commonwealth, and local government partners, shall coordinate a comprehensive program to map and monitor U.S. coral reefs. Such programs shall include, but not be limited to, territories and commonwealths, special marine protected areas such as National Marine Sanctuaries, National Estuarine Research Reserves, National Parks, National Wildlife Refuges, and other entities having significant coral reef resources. To the extent feasible, remote sensing capabilities shall be developed and applied to this program and local communities should be engaged in the design and conduct of programs.

(b) Research. The Task Force shall develop and implement, with the scientific community, research aimed at identifying the major causes and consequences of degradation of coral reef ecosystems. This research shall include fundamental scientific research to provide a sound framework for the restoration and conservation of coral reef ecosystems worldwide. To the extent feasible, existing and planned environmental monitoring and mapping programs should be linked with scientific research activities. This Executive order shall not interfere with the normal conduct of scientific studies on coral reef ecosystems.

(c) Conservation, Mitigation, and Restoration. The Task Force, in cooperation with State, territorial, commonwealth, and local government agencies, nongovernmental organizations, the scientific community and commercial interests, shall develop, recommend, and seek or secure implementation of measures necessary to reduce and mitigate coral reef ecosystem degradation and to restore damaged coral reefs. These measures shall include solutions to problems such as land-based sources of water pollution, sedimentation, detrimental alteration of salinity or temperature, over-fishing, over-use, collection of coral reef species, and direct destruction caused by activities such as recreational and commercial vessel traffic and treasure salvage. In developing these measures, the Task Force shall review existing legislation to determine whether additional legislation is necessary to complement the policy objectives of this order and shall recommend such legislation if appropriate. The Task Force shall further evaluate existing navigational aids, including charts, maps, day markers, and beacons to determine if the designation of the location of specific coral reefs should be enhanced through the use, revision, or improvement of such aids.

(d) International Cooperation. The Secretary of State and the Administrator of the Agency for International Development, in cooperation with other members of the Coral Reef Task Force and drawing upon their expertise, shall assess the U.S. role in international trade and protection of coral reef species and implement appropriate strategies and actions to promote conservation and sustainable use of coral reef resources worldwide. Such actions shall include expanded collaboration with other International Coral Reef Initiative ("ICRI") partners, especially governments, to implement the ICRI through its Framework for Action and the Global Coral Reef Monitoring Network at regional, national, and local levels.

Sec. 6. This order does not create any right or benefit, substantive or procedural, enforceable in law or equity by a party against the United States, its agencies, its officers, or any person.

WILLIAM J. CLINTON

THE WHITE HOUSE,
June 11, 1998.

APPENDIX D: CARRYING CAPACITIES

The conditions and preliminary capacity numbers presented in the "Management Zones" chapter form the basis for determining an overall capacity for the park. To determine the feasibility of commercial services that are proposed by this plan, it is necessary to know the number of visitors that could be served and the potential revenue that would be available to support services.

The table below provides the estimate of park capacity. It was derived by identifying the number of known and potential recreation sites that would reasonably be available for use by visitors. This number was multiplied by the preliminary capacity numbers shown in Table B-1, Carrying Capacity by Alternative and Zone to determine overall preliminary capacities. These capacities will be refined in the future as additional research and monitoring provides improved information and management practices.

TABLE D-1. CARRYING CAPACITY BY ALTERNATIVE AND ZONE

Note: **PAOT** = people at one time. **Natural quiet sites** are sites where the natural soundscape would most likely be present without human interruptions.

ALTERNATIVE B					
RESEARCH NATURAL AREA	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
NA					
NATURAL/CULTURAL	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site		2	12	0	0
Garden Key docks		NA	NA		
Anchorages		NA	NA		
Submerged cultural resource	8	40	40	320	320
Land-based cultural sites	0	4	24	0	0
Night sky viewing sites	0	4	40	0	0
Fishing sites				0	0
Turtle sites	3	5	10	15	30
Natural quiet sites	2	30	80	60	160
Research sites	5	5	10	25	50
Campground		NA	NA		
Sea grass beds		NA	NA		
Reefs deeper than 6 feet	15	32	80	480	1200
Birding sites				0	0
Nesting		0	0	0	0
Migrating	3	50	50	150	150
Beaches	3	40	120	120	360
HISTORIC ADAPTIVE USE	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	1	90	90	90	90
Garden Key docks	1	200	200	200	200
Anchorages	1	80	100	80	100
Submerged cultural resource	2	15	20	30	40
Land-based cultural sites	2	90	115	180	230
Night sky viewing sites	2	80	100	160	200
Fishing sites		24	48	0	0

ALTERNATIVE B					
Turtle sites		NA	NA		
Natural Quiet sites		80	100	0	0
Research sites		NA	NA		
Campground	1	95	100	95	100
Sea grass beds				0	0
Reefs deeper than 6 feet	1	50	75	50	75
Birding sites	1	50	75	50	75
Beaches	2	50	75	50	150
				2,155	3,530

ALTERNATIVE C					
RESEARCH NATURAL AREA	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	NA				
Garden Key docks				0	0
Anchorages				0	0
Submerged cultural resource	5	15	20	75	100
Land-based cultural sites		NA	NA		
Night sky viewing sites		NA	NA		
Fishing sites		NA	NA		
Turtle sites		0	0	0	0
Natural quiet sites		NA	NA		
Research sites	4	1	20	4	80
Campground		NA	NA		
Sea grass beds		NA	NA		
Reefs deeper than 6 feet	8	15	20	120	160
Birding sites				0	0
Nesting		0	0	0	0
Migrating	1	30	50	30	50
Beaches	2	1	6	2	12
NATURAL/CULTURAL	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	N/A				
Garden Key docks		NA	NA		
Anchorages		NA	NA		
Submerged cultural resource	3	30	40	90	120
Land-based cultural sites	0	4	24	0	0
Night sky viewing sites	0	4	40	0	0
Fishing sites				0	0
Turtle sites	2	5	10	10	20
Natural quiet sites	2	30	80	60	160
Research sites	2	5	10	10	20
Campground		NA	NA		
Sea grass beds		NA	NA		
Reefs deeper than 6 feet	7	20	50	140	350
Birding sites				0	0
Nesting		0	0	0	0
Migrating	2	30	50	60	100
Beaches	1	40	120	40	120

ALTERNATIVE C

HISTORIC ADAPTIVE USE	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	1	90	90	90	90
Garden Key docks	1	200	200	200	200
Anchorages	1	80	100	80	100
Submerged cultural resource	2	15	20	30	40
Land-based cultural sites	2	90	115	180	230
Night sky viewing sites	2	80	100	160	200
Fishing sites		24	48	0	0
Turtle sites		NA	NA		
Natural quiet sites		80	100	0	0
Research sites		NA	NA		
Campground	1	95	100	95	100
Sea grass beds				0	0
Reefs deeper than 6 feet	1	50	75	50	75
Birding sites	1	50	75	50	75
Beaches	2	50	75	100	150
				1,676	2,552

ALTERNATIVE D

RESEARCH NATURAL AREA	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	NA				
Garden Key docks				0	0
Anchorages				0	0
Submerged cultural resource		15	20	0	0
Land-based cultural sites		NA	NA		
Night sky viewing sites		NA	NA		
Fishing sites		NA	NA		
Turtle sites		0	0	0	0
Natural quiet sites		NA	NA		
Research sites		1	20	0	0
Campground		NA	NA		
Sea grass beds		NA	NA		
Reefs deeper than 6 feet	5	15	20	75	100
Birding sites				0	0
Nesting		0	0	0	0
Migrating		30	50	0	0
Beaches		1	6	0	0
NATURAL/CULTURAL	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site		2	12	0	0
Garden Key docks		NA	NA		
Anchorages		NA	NA		
Submerged cultural resource	8	30	40	240	320
Land-based cultural sites		4	24	0	0
Night sky viewing sites		4	40	0	0
Fishing sites				0	0
Turtle sites	3	5	10	15	30
Natural quiet sites	1	30	80	30	80

ALTERNATIVE D					
Research sites	4	5	10	20	40
Campground		NA	NA		
Sea grass beds		NA	NA		
Reefs deeper than 6 feet	10	20	50	200	500
Birding sites				0	0
Nesting		0	0	0	0
Migrating	3	30	50	90	150
Beaches	3	40	120	120	360
HISTORIC ADAPTIVE USE	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	1	90	90	90	90
Garden Key docks	1	200	200	200	200
Anchorages	1	80	100	80	100
Submerged cultural resource	2	15	20	30	40
Land-based cultural sites	2	90	115	180	230
Night sky viewing sites	2	80	100	160	200
Fishing sites		24	48	0	0
Turtle sites		NA	NA		
Natural quiet sites		80	100	0	0
Research sites		NA	NA		
Campground	1	95	100	95	100
Sea grass beds				0	0
Reefs deeper than 6 feet	1	50	75	50	75
Birding sites	1	50	75	50	75
Beaches	2	50	75	100	150
				1,825	2,840

ALTERNATIVE E					
RESEARCH NATURAL AREA	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	N/A				
Garden Key docks				0	0
Anchorages				0	0
Submerged cultural resource	8	15	20	120	160
Land-based cultural sites	0	NA	NA		
Night sky viewing sites	0	NA	NA		
Fishing sites		NA	NA		
Turtle sites	3	0	0	0	0
Natural quiet sites	2	NA	NA		
Research sites	5	1	20	5	100
Campground		NA	NA		
Sea grass beds		NA	NA		
Reefs deeper than 6 feet	15	15	20	225	300
Birding sites				0	0
Nesting		0	0	0	0
Migrating	3	30	50	90	150
Beaches	3	1	6	3	18

ALTERNATIVE E					
NATURAL/CULTURAL	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
NA					
HISTORIC ADAPTIVE USE	Total Sites	PAOT lower	PAOT upper	Capacity, lower	Capacity, upper
Shaded picnic/lounging site	1	90	90	90	90
Garden Key docks	1	200	200	200	200
Anchorages	1	80	100	80	100
Submerged cultural resource	2	15	20	40	40
Land-based cultural sites	2	90	115	180	230
Night sky viewing sites	2	80	100	160	200
Fishing sites		24	48	0	0
Turtle sites		NA	NA		
Natural quiet sites		80	100	0	0
Research sites		NA	NA		
Campground	1	95	100	95	100
Sea grass beds				0	0
Reefs deeper than 6 feet	1	50	75	50	75
Birding sites	1	50	75	50	75
Beaches	2	50	75	100	150
				1,488	1,988

APPENDIX E. MORE DETAILS ON COMMERCIAL SERVICES

The Omnibus Park Management Act of 1998 was passed by Congress and signed into law November 13, 1998. Section IV of the Omnibus Act, which deals directly with NPS concessions, is called the National Park Service Concessions Management Improvement Act of 1998. This legislation supercedes the Concessions Policy Act, which has guided NPS management of commercial services for the last 30 years. The new legislation incorporates much of the philosophy of the old law including "development ... shall be limited to those accommodations, facilities, and services that are necessary and appropriate for public use and enjoyment of the unit of the National Park System in which they are located and are consistent to the highest practicable degree with the preservation and conservation of the resources and values of the unit." In addition, the secretary of the interior should "exercise his authority in a manner consistent with a reasonable opportunity for the concessioner to realize a profit." Thus, only economically feasible concession operations should be introduced.

The new law also makes some significant changes. Large (more than $500,000 annual revenues) concessioners are no longer given a right of preference in renewal of contracts. The term of new contracts will normally be 5 to 10 years, with 20-year contracts only issued in special financial situations with approval from the NPS director. Concession permits will be discontinued, and a short-form contract will be used in its place. All franchise fees stay with the Park Service to be used for concession-related or resource protection projects. The park that collects the fees retains 80%, and 20% is used servicewide. Another important provision of the new law is how commercial use authorizations (formerly called **incidental business permits or IBPs**) are managed. The total number of such commercial use authorizations for any activity deemed appropriate might be limited to protect resources or improve visitor experiences.

By law (36 CFR 5.3), a written instrument must authorize all commercial services in national parks. The National Park Service has several authorization tools to choose from to manage commercial services in parks. When a service is offered inside a park that uses parklands and/or facilities, it is usually authorized by a concessions contract. When on a regular basis a commercial activity begins and ends outside the park but uses the park during the activity, the typical instrument used is commercial use authorization (CUA). When a commercial activity that will only occur once is proposed in a park, a special use permit is typically issued. Other instruments, such as commercial filming permits and right-of-way agreements, are used to authorize those associated activities. The Park Service also has cooperative agreements with several nonprofit organizations to sell interpretive books and materials in many visitor centers.

APPENDIX F: RATIONALE FOR SELECTION OF ALTERNATIVE C AS THE PARK SERVICE'S PROPOSED ACTION

This section provides a summary of the reasons and rationale for the National Park Service's selection of alternative C as the preferred alternative. The contents of the *Draft General Management Plan Amendment / Environmental Impact Statement* describe the conditions and impacts that would result from the implementation of each alternative. These impacts, both beneficial and negative, were the basis for making the preferred alternative selection. This section will not redescribe the content of the document but will summarize how the important elements of the alternatives were traded off to arrive at the preferred alternative.

SUMMARY

Each of the alternatives that include a research natural area achieves the objectives for establishing a research natural area. Alternative C does this with the minimum amount of area removed from recreational activity, including fishing, but gains the greatest increment of resource protection. In enlarging the research natural area visitor activity, diversity, and opportunity is significantly reduced in the park. However, managing the remainder of the park as a natural/cultural zone, as in alternative C, does not remove management options in the future. If specific resource and visitor experience conditions are not maintained, park managers have a full range of management tools available to stop impacts, including designated mooring buoys, permits, reservations, guided tours, and site closures.

PROCESS FOR SELECTING THE PREFERRED ALTERNATIVE

The purpose of a general management plan is to guide management actions that will support and fulfill the purposes of the park, which are to

- protect and interpret a pristine subtropical marine ecosystem, including an intact coral reef community
- proactively manage populations of fish and wildlife, including loggerhead and green sea turtles, sooty terns, frigate birds, numerous migratory bird species, and other sensitive species
- safeguard the pristine natural environment of the Dry Tortugas group of islands
- protect, stabilize, restore, and interpret Fort Jefferson, an outstanding example of 19th century masonry fortification
- preserve and protect submerged cultural resources
- provide opportunities for public enjoyment and scientific research in ways consistent with the park purpose

In addition to its purpose, parks within the national park system are managed within the framework of existing laws and policies. Often, however, there is more than one possible course of action that would result in managing within this framework. Such is the case with planning for the future of Dry Tortugas National Park. Five different alternatives are considered in this document, each with a different course of action and different future conditions. Selecting among them required considering all of the relevant facts and information and reasonably weighing the benefits and advantages of each alternative against the advantages of the other alternatives.

The overarching laws and policies that guide management of national parks focus management decisions on five key factors and base every decision on at least one of the following:

preventing the loss of resources
maintaining and improving the condition of resources
providing visitor services, and educational and recreational opportunities
protecting public health safety and welfare
improving operational efficiency and sustainability
protecting employee health safety and welfare

Decisions in the general management plan planning process involve a broad view of the park and its resources and involve a clear evaluation of gains and benefits in resource protection, visitor experience, health and safety, and park operations that are presented by each alternative. The process for selecting a preferred alternative for the Dry Tortugas *General Management Plan Amendment* required defining the key decision factors (from the list above) in a manner that was germane to the key issues of Dry Tortugas and describing for each factor the advantages that each alternative presented. For this process the factors were described as

Maximizing the protection of resources — This included the condition of marine and terrestrial natural resources resulting from implementation of an alternative — the condition of submerged cultural resources; the type and amount of education for resource protection, the amount of monitoring and directing of visitor use; biodiversity and marine populations; surveying, monitoring, and research activity; and the relationship to Florida Keys National Marine Sanctuary's management strategies.

Maximizing the diversity of visitor experiences — This included opportunities for independent and guided travel to and within the park — the level of visitation accommodated and the range of activities available; the degree of challenge and adventure, solitude, and staff encounters; the opportunities for education, interpretation, and information; and the overall quality and diversity of the visitor experience.

Maximized operational efficiency — This included efficiency and effectiveness in operations for resource protection, concessions management, interpretation/education/ information, and maintenance.

Followings is a summary of the advantages of each alternative.

Maximizing the protection of resources

Alternative A would provide the least protection of resources because of impacts from increased visitation, low potential for biodiversity, accomplishing few surveys and monitoring, a low level of research, random educational contact, and few patrols to monitor visitor activities.

Alternative B would provide minor additional protection because there is a better ability to limit visitor numbers, surveys would be completed, resources would be regularly monitored, mooring buoys could direct visitors to less sensitive areas, and patrols would monitor private boaters.

Alternatives C and D would offer greater protection because they establish the minimal are necessary for an effective research natural area, provide greater biodiversity, increase restrictions and controls on visitor behavior, and provide higher levels of research and monitoring.

Alternative E would offer the greatest protection because it establishes a maximum area of research natural area, provides for greater biodiversity, creates maximum restriction and controls on visitor behavior, and establishes higher level of research and monitoring (similar to alternatives C and D). However, the addition of the research natural area does not necessarily constitute significant resource advantages because the preferred configuration provides the necessary range and size of habitats to accomplish zone goals.

Maximizing the diversity of visitor experiences

Alternative A would be the least preferred because degraded resources would result from greater visitor use; also there would be poor control of crowding, poor control of safety and public health; and low-quality visitor experience.

Alternative B would be better, with less crowding, better control, better standards for service, and slightly improved resources for visitors to experience.

Alternative E would be better. It would provide for a more managed and structured experience and limited self-selection of activities by visitors, especially private boaters; there would be fewer options for activities, but there would be better support services, the best means to control crowding, and a greater guarantee of a quality, low-density visitor experience.

Alternatives C and D would be the best with more certainty of intrapark travel, much better control of crowding, better diversity in the opportunities for visitor experiences, more freedom to experience a remote marine environment for private boaters than in a completely managed and structured tour, and a high improvement of resources encountered by visitors.

Maximizing operational efficiency

Alternative A would be least preferred because of understaffing and no control of visitor numbers — too many people doing too many things in too many places.

Alternative B would be better because there would be some limitation on number of visitors and increased staff; there might be mitigation of some public use with better control of visitor numbers and more staff.

Alternatives C and D would be additionally better with improved control of visitors, a better match between use and staff, and more concessioner involvement in park operations and visitor management.

Alternative E would be the most attractive because it would offer the best control of visitors, require less day marker management for the research natural area delineation, match appropriate staff levels with visitation, and provide more concessioner involvement in park operations and visitor management.

Additionally, a separate evaluation was conducted for configuring boundaries of the research natural area. To select an appropriate size and configuration, several factors were applied to the alternatives. Is or does the alternative

1. Represent the full-range of habitats in Dry Tortugas National Park?
2. Have a research natural area zone that is large enough to be self-sustaining — does it contain at least 20% of each of the park's benthic habitats?
3. Have a research natural area zone large enough to maintain apex predators?
4. Consider the larger ecosystem — uplands, shallows, sea grass, and coral?
5. Allow activities that do not detract from research values of the area?

The following tables present the comparison of the alternatives against these factors.

TABLE F-1. REPRESENTATION[2] IN EACH PROPOSAL OF COMMUNITY AND HABITAT TYPES AS MAPPED BY DAVIS (1979)

	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
Total Area of Park included in Proposal	43%	41%	99.5%
Community Type			
Sea Grass (27%)[1]	38%	71%	99.6%
Bank Barrier/ Fringing Reef (<1%)[1]	44%	0%	100%
Patch Reefs (<1%)[1]	71%	34%	99.5%
Algal Communities (<1%)[1]	97%	<1%	100%
Staghorn Reefs (1.8%)[1]	86%	12.4%	91%
Octocoral Hardbottom (16%)[1]	30%	36%	99.9%
Sedimentary Habitats (54%)[1]	47%	30%	99.6%
Land (<1%)[1]	68%[a]	4%	76%[a]

[1] The figures represent the percentage of community and habitat types in all of Dry Tortugas National Park as mapped by Davis (1979).

[2] These data address the criterion requiring that a research natural area represent the full range of habitats. The objective in this evaluation was for 20% or greater representation.

[a] These figures do not take into account the small historic preservation/adaptive use zone on Loggerhead Key. This zone is approximately 10 acres and would be excluded from research natural area designation.

TABLE F-2. THE PERCENTAGE AND (NUMBER) OF LONG-TERM MONITORING SITES[2] INCLUDED IN EACH PROPOSAL

	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
Coral (5)[1]	80%(4)	20%(1)	100%(5)
Water Quality (5)	60%(3)	20%(1)	100%(5)
NOAA Reef Fish (9)	56%(5)	11%(1)	100%(9)
Reef Fish (12)	75%(9)	33%(4)	100%(12)
Sea Grass (9)	44%(4)	33%(3)	89%(8)
USGS (9)	78%(7)	22%(2)	100%(9)
Lobster (57)	53%(30)	7%(4)	96%(55)
TOTAL(49)			

[1] These figures represent the total number of monitoring locations by subject of interest in the entire park.
[2] These data address the criterion requiring that a research natural area include previous research and long-term monitoring sites. The objective for this evaluation was 50% or greater.

TABLE F-3. THE PRESENCE OR ABSENCE OF SPAWNING AGGREGATION AREAS[1] IN EACH PROPOSAL

	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
Snapper	Partial	Yes	Yes
Grouper	No	No	Yes

[1] These data address the criterion suggesting that a research natural area include fish spawning aggregation areas. The objective for this evaluation was for full inclusion of both areas.

TABLE F-4. REPRESENTATION[2] IN EACH PROPOSAL OF WATER DEPTHS AS MAPPED BY FDEP/FMRI.

	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
TOTAL AREA OF PARK INCLUDED IN PROPOSAL	43%	41%	99.5%
Bathymetry			
0 – 3 Feet (1%)[1]	83%	6%	96%
3 – 6 Feet (3%)[1]	54%	33%	98%
6 – 12 Feet (7%)[1]	28%	41%	98%
12 – 18 Feet (6%)[1]	32%	45%	99.7%
18 - 30 Feet (12%)[1]	32%	36%	99.0%
30 - 60 Feet (52%)[1]	50%	50%	99.6%
60 - 100 Feet (17%)[1]	33%	22%	100%

[1] These figures represent the percentage of water depths in the park as mapped by FDEP/FMRI.
[2] These data are used as a surrogate to address criteria suggesting that a research natural area be large enough to be self-sustaining, encompass a wide variety of essential contiguous habitat, and maximize biodiversity. The objective for this evaluation was 20% or greater representation.

Table F-5. Inclusion[1] in Each Proposal of Areas That Best Represent the Park's Benthic Communities (Jaap pers. com., Fourqueran pers. com., Wheaton pers. com., and Jaap et al. 1998)

	Research Natural Area, Alternative C	**Research Natural Area, Alternative D**	**Research Natural Area, Alternative E**
Community Type			
Bank Barrier/Fringing Reef			
Bird Key Reef (Long Key Reef) – 1	Yes	No	Yes
Patch Reefs			
Loggerhead Reef – 2	Yes	No	Yes
Little Africa – 3	Yes	No	Yes
Texas Rock – 4	Yes	Yes	Yes
Algal Communities			
E of White Shoal – 5	Yes	No	Yes
SSE of Fort Jefferson Harbor – 6	Yes	No	Yes
Staghorn Reefs			
NE edge of White Shoal – 7	Yes	No	Yes
Octocoral Hardbottom			
Area west of Pulaski ShoalLight – 8	No	No	Yes
Sea Grass			
Site A – 9	Yes	Yes[2]	Yes
Site B – 10	Yes[2]	Yes	Yes
Coral Species at Risk			
***Acropora palmata* thicket – 11**	Yes	No	Yes

[1] These data address the criterion requiring that a research natural area represent the full range of habitats.

[2] These locations are either on or just inside the proposed research natural area boundary and may not be sufficiently buffered from activities outside the research natural area. The objective for this evaluation was full inclusion of sites.

Table F-6. Measures of Distance from a Law Enforcement Station and Measures of Boundary Complexity[5]

	Research Natural Area, Alternative C	**Research Natural Area, Alternative D**	**Research Natural Area, Alternative E**
Distance[1] to centroid[2]	2.6	4.5	1.5
Distance[1] to farthest corner	6.7	8.2	8.3
Number of new boundaries[3]	7[a]	2	3[b]
Uses lines of latitude and longitude	Some[4]	Yes	Some[4c]
Total acreage of the proposal	27,905	26,721	64,453

[1] Distance is measured in statute miles from Garden Key. To convert statute miles into nautical miles multiply by 0.8684. To convert nautical miles into statute miles multiply by 1.1516.

[2] Levels of poaching in Caribbean marine reserves are significant and correlated with distance from a law enforcement station. Therefore it seems reasonable to consider the location of a given proposal relative to Garden

Key (currently the center of law enforcement activity at the park). The "centroid" is defined as the center of mass of an object having constant density.

[3] As a possible measure of complexity related to enforcement we might consider the number of additional "new boundaries" or line segments that are required by each configuration.

[4] These proposed configurations make use of some line segments that are not whole minutes of latitude and longitude. However, the effect this may have on the enforcement or identity of an area has not been determined.

[5] These data address the criterion suggesting that a research natural area be enforceable and identifiable.

[a] Six of the new boundary segments in this proposed configuration are straight lines, while the seventh proposes to follow a bathymetric contour and other navigation-related benthic features.

[b] Two of the new boundary segments in this proposed configuration are straight lines, while the third proposes to follow a bathymetric contour and other navigation-related benthic features.

[c] Although this alternative makes use of some line segments that are not whole minutes of latitude and longitude, with the exception of the excluded area around Garden Key, the boundaries of the proposed research natural area are coincidental with that of the park, thereby significantly reducing complexity and improving identity.

TABLE F-7. LENGTH AND PERCENT OF SHARED BOUNDARY WITH THE SANCTUARY'S ECOLOGICAL RESERVE AS A MEASURE OF COMPATIBILITY AND CONNECTIVITY WITH THE TORTUGAS ECOLOGICAL RESERVE OUTSIDE THE PARK BOUNDARY[2]

	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
Length[1] and percent of shared boundary	8.8(70%)	12.5(100%)	12.5(100%)

[1] Length is measured in statute miles.

[2] These data address the criterion suggesting that a research natural area consider the larger ecosystem and be compatible with the Florida Keys National Marine Sanctuary's Tortugas Ecological Reserve.

TABLE F-6A. MEASURES OF DISTANCE FROM A LAW ENFORCEMENT STATION AND MEASURES OF BOUNDARY COMPLEXITY[5]

	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
Distance[1] to centroid[2]	2.6 (Better)	4.5 (Good)	1.5 (Best)
Distance[1] to farthest corner	6.7 (Best)	8.2 (Good)	8.3 (Good)
Number of new boundaries[3]	7[a] (Good)	2 (Better)	3[b] (Best)
Uses lines of latitude and longitude	Some[4] (Good)	Yes (Better)	Some[4c] (Best)
Total acreage of the proposal	27,905 (Better)	26,721 (Best)	64,453 (Good)

[1] Distance is measured in statute miles from Garden Key. To convert statute miles into nautical miles multiply by 0.8684. To convert nautical miles into statute miles multiply by 1.1516.

[2] Levels of poaching in Caribbean marine reserves are significant and correlated with distance from a law enforcement station. Therefore it seems reasonable to consider the location of a given proposal relative to Garden Key (currently the center of law enforcement activity at the park). The "centroid" is defined as the center of mass of an object having constant density.

[3] As a possible measure of complexity related to enforcement we might consider the number of additional "new boundaries" or line segments that are required by each configuration.

[4] These proposed configurations make use of some line segments that are not whole minutes of latitude and longitude. However, the effect this may have on the enforcement or identity of an area has not been determined

[5] These data address the criterion suggesting that a research natural area be enforceable and identifiable.

[a] Six of the new boundary segments in this proposed configuration are straight lines, while the seventh proposes to follow a bathymetric contour and other navigation-related benthic features.
[b] Two of the new boundary segments in this proposed configuration are straight lines, while the third proposes to follow a bathymetric contour and other navigation-related benthic features.
[c] Although this alternative makes use of some line segments that are not whole minutes of latitude and longitude, with the exception of the excluded area around Garden Key, the boundaries of the proposed research natural area are coincidental with that of the park, thereby significantly reducing complexity and improving identity.

TABLE F-8: APPROXIMATE PERCENTAGE OF FISHING ZONE [1] INCLUDED IN PROPOSED RESEARCH NATURAL AREA INSIDE THE PARK

Number of Fishing Trips 1981–84	Fishing Zone	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
3 (0.75%)	1	100	100	100
93 (16%)	2	100	23	100
10 (2%)	3	0	0	100
24 (4%)	4	76	100	100
369 (63%)	5	64	25	97
30 (5%)	6	0	0	100
12 (2%)	7	0	65	100
43 (7%)	8	0	18	100
1 (0.25%)	9	0	0	100
TOTAL TRIPS = 585				

[1] These data address the criterion suggesting that a research natural area consider impacts on visitor activities and commercial services (e.g., recreational fishing). Alternatives that impact recreational fishing opportunities the least in zones 2, 5, and 8 were considered more favorable.

TABLE F-9. SUMMARY OF HOW EACH PROPOSAL SATISFIES THE CRITERIA FOR IDENTIFYING RESEARCH NATURAL AREAS

RESEARCH NATURAL AREA CRITERIA	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
I. Represent the Full Range of Habitats at the Park			
A. Does the research natural area contain the full range of habitats? (table F-1)	Yes	No	Yes
B. Does the research natural area contain at least 20% of each habitat type? (table F-1)	Yes	No	Yes
C. Does the research natural area include areas that best represent each benthic community? (table F-5)	Most	Very Few	All
D. Does the research natural area provide protection for species at risk? (table F-11)	Yes	No	Yes
II. Include Previous Research and Long-term Monitoring Sites			

RESEARCH NATURAL AREA CRITERIA	Research Natural Area, Alternative C	Research Natural Area, Alternative D	Research Natural Area, Alternative E
A. Does the research natural area include the full range of monitoring sites? (table F-2)	Yes	Yes	Yes
B. Does the research natural area include at least 50% of long-term monitoring sites? (table F-2)	Most	No	All
III. SUFFICIENT SIZE TO CONTAIN APEX PREDATORS			
A. Does the research natural area provide apex predator protection? (table F-10)	Suitable	Marginal	Suitable
IV. Large Enough to be Self-Sustaining			
A. Does the research natural area include known spawning aggregation areas? (table F-3)	Partial	One	Both
B. Does the research natural area include the full range of bathymetry? (table F-4)	Yes	Yes	Yes
C. Does the research natural area include at least 20% of each bathymetry class? (table F-4)	Yes	Most	Yes
V. Enforceable and Identifiable			
A. Does the research natural area location encourage compliance and facilitate enforcement? (tables F-6 and F-6A)	Best	Good	Better
B. How complex is the research natural area boundary? (tables F-6 and F-6A)	Good	Better	Best
C. How large is the research natural area? (tables F-6 and F-6A)	Better	Best	Good
VI. Considers Socioeconomic Impacts			
A. What is the impact of the research natural area on recreational fishing? (table F-8)	Medium	Low	High
VII. Considers Larger Ecosystem			
A. Is the research natural area contiguous with the sanctuary's ecological reserve? (table F-7)	Partial	Full	Full

TABLE F-10. APEX PREDATOR ANALYSIS IN DRY TORTUGAS REGION

Data based on fish density (numbers of fish seen/Bohnsack-Ault 1994–98 visual census sample) and mean size (cm). Density represents a measure of population stability and resiliency; adult average size represents a measure of yield potential. Data cited from Schmidt et al. 1999.

Apex Predators by Density & Size	Alternative C (6-sites)	Alternative D (1-site)	Alternative E (8 sites)
Black Grouper-Density-Pre-recruit	0-(0.2)	-0-	0-(0.2)
Black Grouper- Size-(Exploited)	56-60, 66-75 cm (2 of 6 sites)	-0-	56-60, 66-75 cm (3 of 8 sites)
Red Grouper-Density-pre-recruit	0-(0.304-0.625)	-0-	0-(0.304-0.625)
Red Grouper (size-Exploited)	0-(1-55)	-0-	0-(65-70 cm)
All Grouper combined/Density/ Pre-recruits	0-(0.6-0.9)	-0-	0-(0.6-0.9)
All Large Grouper Combined/Density/ Exploited	0-(0.2-0.3)	-0-	0-(0.2-0.3)
Yellow-tail Snapper Density-Pre-recruit	0-16	0-16	0-16
Yellowtail Snapper Size (Exploited)	0-(36-50 cm)	36-50	0-(36-50)
Gray Snapper Density-Pre-recruits	0-(1-5)	1-5	0-(1-5)
Gray Snapper Size-Exploited	34-38 (3 of 6 sites)	31-34	(31-34-(34-38) (5 of 8 sites)
Mutton Snapper Density-Pre-recruits	None collected	None collected	None collected
Mutton Snapper Size-(Exploited)	0-(50-60)(3 of 6 sites)	-0-	0-(50-60) (3 of 8 sites)
	(29 sites)	(6 sites)	(56 sites)
Spiny Lobster Density-	0-5, 39-66	0-5, 39-66	0-5, 66-231
Spiny Lobster Size	75/84-145/154	75/84-110/119	75/84-154/162

TABLE F-11. DRAFT LIST OF MARINE FISH/CORAL REEF FISH STOCKS AT RISK IN THE PARK

COMMON NAME	SCIENTIFIC NAME	PARK LOCATION	SURVEY, SOURCE	PROTECTION CRITERIA
Goldentail moray	*Muraena milaris*	Park	Rydene & Kimmel, 1990-94	Rare, not currently protected
Spotted eagle ray	*Aetobatus narinari*	Pulaski shoal, Loggerhead Reef	Longley & Hildebrand, 1941;Schmidt 1976	Threatened, state protected
Mottled cusk-eel	*Lepophidium* sp. *(jennae)*	White Shoal	Longley & Hildebrand, 1941; Robbins et al 1986	Rare, not currently protected
Common Snook	*Centropomus undecimalis*	Pulaski shoal, Loggerhead reef	Schmidt (1976)	Species of special concern-state of Florida
Nassau grouper	*Epinephelus striatus*	White Shoal, Long Key Reef	Longley & Hildebrand, 1941 and many others	Depleted, fed-state protected; Proposed IUCN, AFS threatened sp.
Jewfish	*E. itajara*	Windjammer wreck, Texas Rock, Long Key reef	Longley & Hildebrand, 1941 and many others	Depleted, fed-state protected; Proposed for IUCN, AFS threatened sp. lists
Speckled hind	*E. drummondhayi*	Park	Bohnsack et al. 1994	Depleted, proposed for IUCN, AFS threatened sp. lists.
Mutton hamlet	*E. afer*	Park	Longley & Hildebrand, 1941	Rare, not currently protected
Coney	*E. fulvus*	Park-A 60' channel	Longley & Hildebrand, 1941	Depleted, proposed AFS threatened sp. list.
Yellowmouth grouper	*Mycteroperca interstitialis*	Park-East Key	Longley & Hildebrand, 1941;Bohensack et al. 1994	Rare (park); Depleted, TERA

COMMON NAME	SCIENTIFIC NAME	PARK LOCATION	SURVEY, SOURCE	PROTECTION CRITERIA
Yellowfin grouper	*M. venosa*	Loggerhead Key	Longley & Hildebrand, 1941;Bohensack et al. 1994	Depleted, not currently protected
Scamp	*M. phenax*	Park	Rydene & Kimmel, 1990-94;	Rare (park), not currently protected
Gag	*M. microlepsis*	Loggerhead Key/Bird Key reef flats	Longley & Hildebrand, 1941 and others	Proposed as "vulnerable" by IUCN.
Orangeback bass	*S. annualaris*	Park	Rydene & Kimmel, (1990-94)	Rare (<100' depth) (park), not currently protected
Blue hamlet	*Hypoplecterus gemma*	White shoal, Loggerheard K, Windjammer, Long Key	Longley & Hildebrand, 1941 and others	Proposed AFS threatened sp. List
Greater soapfish	*Rypticus saponaceous*	"Windjammer"	Jordan & Thompson, 1905; Schmidt (1976)	Rare, not currently protected
Royal gramma	*Gramma loreto*	White shoal	Schmidt (1976)	Rare, One individual observed Not previously reported in Fla (Humann,1994)
Night sergeant	*Abududuf taurus*	Loggerhead Key, Garden Key	Longley & Hildebrand, 1941	Rare, not currently protected
Hogfish	*Lachnolaimus maximus*	White shoal, Long Key	Longley & Hildebrand, 1941 and many others	Depleted, proposed foe IUCN "vulnerable" sp. List.
Dwarf wrasse	*Doratonotus megalepsis*	Turtle grass/Loggerhead key	Longley & Hildebrand, 1941, Rydene & Kimmel, 1990-94	Rare, currently not protected
Lancer dragonet	*Diplogrammus pauciradiatus*	Loggerhead Bank	Longley & Hildebrand, 1941	Rare one specimen collected, not protected
Swordtail jawfish	*Lonchopisthus micrognathus*	Loggerhead reef	Longley & Hildebrand, 1941	Rare, currently not protected
Mottled jawfish	*Opistognathus maxillosus*	Loggerhead reef	Longley & Hildebrand, 1941	Rare, currently not protected
Freckled stargazer	*Gnathsgnus egregius*	Loggerheah reef	Longley & Hildebrand, 1941	Rare, not currently protected
Saddle stargazer	*Platygillellus rubrocinctus*	Park	Longley & Hildebrand, 1941	Rare, currently not protected
Roughhead blenny	*Acanthemblemaria aspera*	Park	Longley & Hildebrand, 1941	First reported as common, now rare, not protected
Spinyhead blenny	*A. spinosa*	Park	Rydene & Kimmel (1990-94) Hildebrand unable to confirm identity	Rare, not currently protected
Glass blenny	*Coraliozetus diaphana*	Tortugas atoll	Longley & Hildebrand, 1941	Rare, currently not protected
Wrasse blenny	*Hemiemblemaria simulus*	Tortugas atoll	Longley & Hildebrand, 1941, Rydene & Kimmel, (1990-94)	Rare, currently not protected
Mutton snapper	*Lutjanus analis*	White shoal, Long Key	Longley & Hildebrand, 1941, and others	Depleted, proposed IUCN "vulnerable" sp.
Rainbow parrotfish	*Scarus guacamaia*	Park	Longley & Hildebrand, 1941; Rydene & Kimmel, 1990-94	Rare, proposed IUCN "vulnerable" sp. list.
Key blenny	*Starksia starcki*	Park	Longley & Hildebrand, 1941, Jones & Thompson, 1978	Rare, proposed AFS threatened sp. list.
Checkered blenny	*S. ocellata*	Bird Key reef	Longley & Hildebrand, 1941	Rare, not currently protected
Hairy blenny	*Labrisomus nuchipinnis*	Loggerhead key, Garden Key	Longley & Hildebrand, 1941	Reported rare by Longley & Hildebrand, 1941
Downy blenny	*L. kalisherae*	Bird Key reef	Longley & Hildebrand, 1941	Currently reported rare in Park.
Longfin blenny	*L. haitiensis*	Bird Key flats	Longley & Hildebrand, 1941	Rarely collected, not protected
Bluethroat Pikeblenny	*Chaenopsis ocellatus*	Bird Key flats	Longley & Hildebrand, 1941	Rare, not currently protected
Diamond blenny	*Malacoctenus boehlkei*	Park	Rydene & Kimmel, 1990-94	Rare, not currently protected. Humann 1994 reports not in Florida.
Barfin blenny	*M. versicolor*	Bird key flats, Loggerhead reef	Longley & Hildebrand, 1941; Rydene & Kimmel, 1990-94	Rare, not currently protected. Humann 1994 reports not in Florida.
Barred blenny	*Hypleurochilus bermudensis*	Park-Logerhead Reef	Longley & Hildebrand, 1941; Bohnsack & McClellan, 1998	Rare, not currently protected

COMMON NAME	SCIENTIFIC NAME	PARK LOCATION	SURVEY, SOURCE	PROTECTION CRITERIA
Sharpnose goby	*Gobiosoma evelyane*	Park	Rydene & Kimmel, 1990-94	Rare, currently not protected, previously not reported in Florida (Humann, 1994)
Cleaning goby	*Gobiosoma genie*	Park	Rydene & Kimmel, 1990-94	Rare, currently not protected, previously not reported in Florida (Humann, 1994)
Leopard goby	*Gobiosoma saucrum*	Park	Rydene & Kimmel, 1990-94	Rare, not currently protected
Notchtongue goby	*Bathygobius curacao*	Bird Key reef	Longley & Hildebrand, 1941	Rare, not currently protected
Sponge goby	*Evermannichthys spongicola*	Park-sponge habitat	Longley & Hildebrand, 1941	Rare, not currently protected
Marked goby	*Gobionellus stigmaticus*	Loggerhead Key shoreline	Longley & Hildebrand, 1941	Rare, not currently protected
Rusty goby	*Priolepsis hipoliti*	Park	Rydene & Kimmel, 1990-94	Rare, not currently protected
Banner goby	*Microgobius microlepsis*	Bird Key flats/Bush Key flats	Longley & Hildebrand, 1941; Schmidt (1976)	Rare, not currently protected
Pugnose wormfish	*Cerdale floridana*	Bird key reef	Longley & Hildebrand, 1941	Rare, not currently protected
Spotted whiff	*Citharichthys macrops*	Loggerhead bank	Longley & Hildebrand, 1941	Rare, 1 specimen reported
Marbled puffer	*Spheroides dorsalis*	60' channels adjacent to Garden Key, Bird/Bush Keys	Longley & Hildebrand, 1941	Rare, currently not protected
Honeycomb cowfish	*Lactophys polygonia*	Park	Rydene & Kimmel. 1990-94; Robbins et al. 1986	Rare, not currently protected; not reported in Gulf of Mexico

APPENDIX G: DETAILS OF NATURAL RESOURCE DATA GATHERED AND PROJECTED

Table A2: **(a)** Description of reef type classification. **(b)** Total area (in m^2) of underwater (benthic) habitats within the park; areas are given by depth category (less than and greater than 3 m) and for the total area. **(c)** Proportion of benthic habitat areas contained within a research natural area zone for alternatives C and D.

(a)

Reef Type	**Description**
Patch Reef	Small diffuse reefs consisting mainly of large boulder corals, which are often surrounded by a halo of barren sand caused by grazing on surrounding sea grass.
Reef Flat	Shallow to medium depth reefs consisting mainly of coral outcroppings, sand patches, and scattered sea grass beds.
Fore Reef	Areas of extensive coral growth that include spur-and-groove formations characterized by a wide depth range.
Deep Reef	Reefs at depths greater than 22 meters.

(b)

Benthic Habitat	**Area <=3 m in depth**	**Area >3 m in depth**	**Total Area**
Hardbottom	157,382	0	157,382
Sand	1,213,788	115,872,419	117,086,208
Sea grass	9,941,308	34,440,246	44,381,554
Patch Reefs	637,419	28,086,108	28,723,527
Reef Flat	9,125,964	36,758,816	45,884,779
Fore Reefs	427,995	11,036,247	11,464,242
Deep Reefs	0	1,497,517	1,497,517
Total	**21,503,856**	**227,691,353**	**249,195,209**

(c)

	Alternative C			Alternative D		
Benthic Habitat	**≤3 m**	**>3 m**	**Total**	**≤3 m**	**>3 m**	**Total**
Hardbottom	100.0	NA	100.0	0.0	NA	0.0
Sand	78.7	40.0	40.4	2.9	20.1	20.0
Sea Grass	43.0	20.6	25.6	26.0	41.4	37.8
Coral Reefs	41.5	41.3	41.3	25.5	36.0	34.8

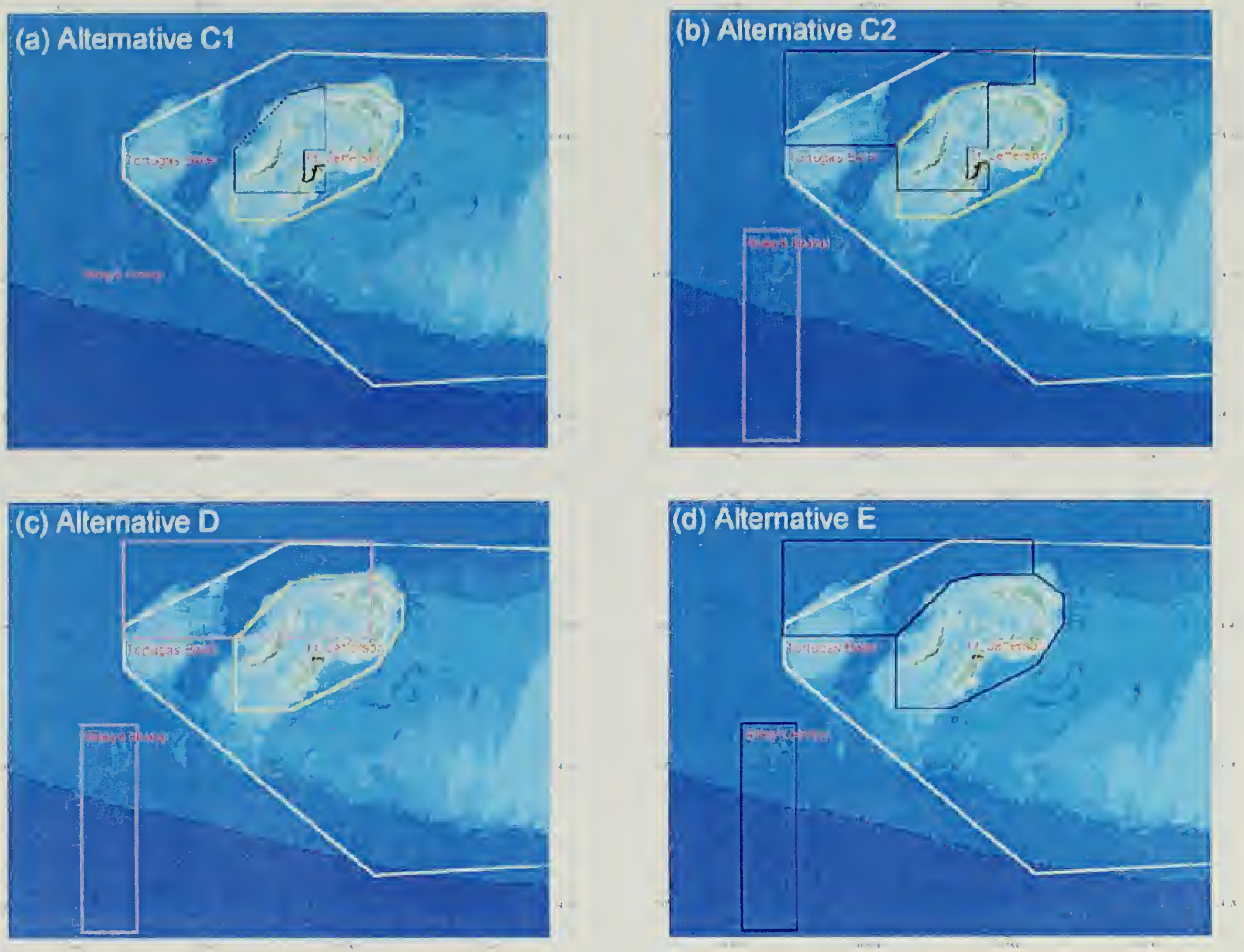

Figure B5: Diagram showing the spatial extents and boundaries of NPS research natural areas and the Florida Keys National Marine Sanctuary's ecological reserves (ERs) for three proposed management alternatives and one nonalternative scenario: (a) alternative C without the sanctuary's ecological reserves (not considered in the document); (b) alternative C with the sanctuary's ecologic reserves: (c) alternative D: and (d) alternative E. Alternatives A and B have no research natural area zone.

APPENDIX H: LETTERS FROM THE U.S. FISH AND WILDLIFE SERVICE ON RARE, THREATENED, AND ENDANGERED SPECIES

March 3 1849

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecosystem Office
P.O. Box 2676
Vero Beach, Florida 32961-2676

August 6, 1999

Margaret L. DeLaura
Community Planner
National Park Service
Denver Service Center
P.O. Box 25287
Denver, CO 80225-0287

Dear Ms. DeLaura:

Thank you for the June 28, 1999 letter to the U.S. Fish and Wildlife Service (Service) on behalf of Dry Tortugas National Park (Park) requesting information on federally listed species and designated critical habitat. Your office requested the information for an environmental impact statement which is being prepared for the Park's general management plan amendment in Monroe County. The Park is located in waters of the Gulf of Mexico, approximately 70 miles west of Key West, Monroe County, Florida.

The Service has reviewed the information submitted and examined the information available to us on the presence of threatened and endangered species in the vicinity of the site. We have provided for your consideration a list of species that are protected as threatened or endangered under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), in Monroe County. Five species of sea turtles may be found in the waters of the Park, and the loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles nest on Park islands. Additionally, the West Indian manatee (*Trichechus manatus*) and a number of bird species utilize the islands and waters within the Park. There is no designated critical habitat within Park boundaries.

We have also provided you with a list of species that we would consider during our review of any proposal associated with this project. This list represents species that the Service is required to protect and conserve under other authorities, such as the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*) and the Migratory Bird Treaty Act (16 U.S.C. 701 *et seq.*). We are providing this list as technical assistance only.

Since the enclosed lists do not include species protected by the State, we recommend you contact the Florida Fish and Wildlife Conservation Commission (FWCC) to identify those species potentially present in the vicinity. The local office of the FWCC may be reached at 2796 Overseas Highway, Suite 213, Marathon, FL 33050; telephone (305)289-2365.

Thank you for the opportunity to provide this information. If you have any questions, please contact Ms. Jeanette Gallihugh at our Florida Keys Suboffice, P.O. Box 430510, Big Pine Key, FL 33043; telephone (305)872-5563.

Sincerely,

Jeanette Gallihugh
FOR James J. Slack
Project Leader
South Florida Field Office

enclosures

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES AND CANDIDATES FOR FEDERAL LISTING IN MONROE COUNTY, FLORIDA

Mammals (except whales)

Florida panther	*Felis concolor coryi*	E
Mountain lion	*Felis concolor...*	T (S/A)
Key deer	*Odocoileus virginianus clavium*	E
Key Largo cotton mouse	*Peromyscus gossypinus allapaticola*	E
Key Largo woodrat	*Neotoma floridana smalli*	E
Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	E
Silver rice rat	*Oryzomys palustris natator* (= *O. argentatus*)	E, CH
West Indian manatee	*Trichechus manatus*	E, CH

Birds

Audubon's crested caracara	*Polyborus plancus audubonii*	T
Bald eagle	*Haliaeetus leucocephalus*	T
Cape Sable seaside sparrow	*Ammodramus (=Ammospiza) maritimus mirabilis*	E, CH
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E
Piping plover	*Charadrius melodus*	T
Red-cockaded woodpecker	*Picoides (= Dendrocopos) borealis*	E
Roseate tern	*Sterna dougallii dougallii*	T
Wood stork	*Mycteria americana*	E

Reptiles

American crocodile	*Crocodylus acutus*	E, CH
American alligator	*Alligator mississippiensis*	T (S/A)
Atlantic salt marsh snake	*Nerodia clarkii (=fasciata) taeniata*	T
Eastern indigo snake	*Drymarchon corais couperi*	T
Green sea turtle	*Chelonia mydas* (incl. *agassizi*)	E
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Kemp's (=Atlantic) ridley sea turtle	*Lepidochelys kempii*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Loggerhead sea turtle	*Caretta caretta*	T

Invertebrates

Schaus swallowtail butterfly	*Heraclides (= Papilio) aristodemus ponceanus*	E
Stock Island tree snail	*Orthalicus reses (*not incl. *nesodryas)*	T

Plants

Garber's spurge	*Chamaesyce(=Euphorbia) garberi*	T
Key tree-cactus	*Pilosocereus (= Cereus) robinii*	E

E=Endangered; T=Threatened; C=Candidate; T (S/A)=Threatened due to Similar Appearance; XN=Experimental population; CH = Critical Habitat has been designated for this species in this county

South Florida Field Office revised 1/8/99

MIGRATORY BIRDS OCCURRING IN SOUTH FLORIDA

ORDER GAVIIFORMES
FAMILY GAVIIDAE
Gavia stellata, Red-throated Loon
Gavia immer, Common Loon
Gavia pacifica, Pacific Loon

ORDER PODICIPEDIFORMES
FAMILY PODICIPEDIDAE
Tachybaptus dominicus, Least Grebe
Podilymbus podiceps, Pied-billed Grebe
Podiceps auritus, Horned Grebe
Podiceps nigricollis, Eared Grebe

ORDER PROCELLARIIFORMES
FAMILY PROCELLARIIDAE
Calonectris diomedea, Cory's Shearwater
Puffinus gravis, Greater Shearwater
Puffinus griseus, Sooty Shearwater
Puffinus puffinus, Manx Shearwater
Puffinus lherminieri, Audubon's Shearwater

FAMILY HYDROBATIDAE
Oceanites oceanicus, Wilson's Storm-Petrel
Oceanodroma leucorhoa, Leach's Storm-Petrel
Oceanodroma castro, Band-rumped Storm-Petrel

ORDER PELECANIFORMES
FAMLY PHAETHONTIDAE
Phaethon lepturus, White-tailed Tropicbird
Phaethon aethereus, Red-billed Tropicbird

FAMILY SULIDAE
Sula dactylatra, Masked Booby
Sula leucogaster, Brown Booby
Sula sula, Red-footed Booby
Sula bassanus, Northern Gannet

FAMILY PELECANIDAE
Pelecanus erythrorhynchos, American White Pelican
Pelecanus occidentalis, Brown Pelican

FAMILY PHALACROCORACIDAE
Phalacrocorax carbo, Great Cormorant
Phalacrocorax auritus, Double-crested Cormorant

FAMILY ANHINGIDAE
Anhinga anhinga, Anhinga

FAMILY FREGATIDAE
Fregata magnificens, Magnificent Frigatebird

ORDER CICONIIFORMES
FAMILY ARDEIDAE
Botaurus lentiginosus, American Bittern
Ixobrychus exilis, Least Bittern
Ardea herodias, Great Blue Heron
Casmerodius albus, Great Egret
Egretta thula, Snowy Egret
Egretta caerulea, Little Blue Heron
Egretta tricolor, Tricolored Heron
Egretta rufescens, Reddish Egret
Bubulcus ibis, Cattle Egret
Butorides striatus, Green-backed Heron
Nycticorax nycticorax, Black-crowned Night Heron
Nycticorax violaceus, Yellow-crowned Night Heron

FAMILY THRESKIORNITHIDAE
Eudocimus albus, White Ibis
Eudocimus ruber, Scarlet Ibis
Plegadis falcinellus, Glossy Ibis
Plegadis chihi, White-faced Ibis
Ajaia ajaja, Roseate Spoonbill

FAMILY CICONIIDAE
Mycteria americana, Wood Stork

ORDER PHOENICOPTERIFORMES
FAMILY PHOENICOPTERIDAE
Phoenicopterus ruber, Greater Flamingo

ORDER ANSERIFORMES
FAMILY ANATIDAE
Dendrocygna bicolor, Fulvous Whistling-Duck
Dendrocygna autumnalis, Black-bellied Whistling-Duck
Anser albifrons, Greater White-fronted Goose
Chen caerulescens, Snow Goose
Branta bernicla, Brant
Branta canadensis, Canada Goose
Aix sponsa, Wood Duck
Anas crecca, Green-winged Teal
Anas rubripes, American Black Duck
Anas fulvigula, Mottled Duck
Anas platyrhynchos, Mallard
Anas bahamensis, White-cheeked Pintail
Anas acuta, Northern Pintail
Anas discors, Blue-winged Teal
Anas cyanoptera, Cinnamon Teal
Anas clypeata, Northern Shoveler
Anas strepera, Gadwall
Anas penelope, Eurasian Wigeon
Anas americana, American Wigeon
Aythya valisineria, Canvasback
Aythya americana, Redhead
Aythya collaris, Ring-necked Duck
Aythta marila, Greater Scaup
Aythya affinis, Lesser Scaup
Somateria mollissima, Common Eider
Somateria spectabilis, King Eider
Histrionicus histrionicus, Harlequin Duck
Clangula hyemalis, Oldsquaw
Melanitta nigra, Black Scoter
Melanitta perspicillata, Surf Scoter
Melanitta fusca, White-winged Scoter
Bucephala clangula, Common Goldeneye

Bucephala albeola, Bufflehead
Lophodytes cucullatus, Hooded Merganser
Mergus merganser, Common Merganser
Mergus serrator, Red-breasted Merganser
Oxyura jamaicensis, Ruddy Duck
Oxyura dominica, Masked Duck

ORDER FALCONIFORMES
FAMILY CATHARTIDAE
Coragyps atratus, Black Vulture
Cathartes aura, Turkey Vulture

FAMILY ACCIPITRIDAE
Pandion haliaetus, Osprey
Elanoides forficatus, American Swallow-tailed Kite
Elanus caeruleus, Black-shouldered Kite
Rhostrhamus sociabilis, Snail Kite
Ictinia mississippiensis, Mississippi Kite
Haliaeetus leucocephalus, Bald Eagle
Circus cyaneus, Northern Harrier
Accipiter striatus, Sharp-shinned Hawk
Accipiter cooperii, Cooper's Hawk
Buteo lineatus, Red-shouldered Hawk
Buteo platypterus, Broad-winged Hawk
Buteo brachyurus, Short-tailed Hawk
Buteo swainsoni, Swainson's Hawk
Buteo jamaicensis, Red-tailed Hawk

FAMILY FALCONIDAE
Polyborus plancus, Crested Caracara
Falco sparverius, American Kestrel
Falco columbarius, Merlin
Falco peregrinus, Peregrine Falcon

ORDER GRUIFORMES
FAMILY RALLIDAE
Coturnicops noveboracensis, Yellow Rail
Laterallus jamaicensis, Black Rail
Rallus longirostris, Clapper Rail
Rallus elegans, King Rail
Rallus limicola, Virginia Rail
Porzana carolina, Sora
Porphyrula martinica, Purple Gallinule
Gallinula chloropus, Common Moorhen
Fulica americana, American Coot

FAMILY ARAMIDAE
Aramus guarauna, Limpkin

FAMILY GRUIDAE
Grus canadensis, Sandhill Crane

ORDER CHARADRIIFORMES
FAMILY CHARADRIIDAE
Pluvialis squatarola, Black-bellied Plover
Pluvialis dominica, Lesser Golden-Plover
Charadrius alexandrinus, Snowy Plover
Charadrius wilsonia, Wilson's Plover
Charadrius semipalmatus, Semipalmated Plover
Charadrius melodus, Piping Plover
Charadrius vociferus, Killdeer
Charadrius montanus, Mountain Plover

FAMILY HAEMATOPODIDAE
Haematopus palliatus, American Oystercatcher

FAMILY RECURVIROSTRIDAE
Himantopus mexicanus, Black-necked Stilt
Recurvirostra americana, American Avocet

FAMILY SCOLOPACIDAE
Tringa melanoleuca, Greater Yellowlegs
Tringa flavipes, Lesser Yellowlegs
Tringa solitaria, Solitary Sandpiper
Catoptrophorus semipalmatus, Willet
Actitus macularia, Spotted Sandpiper
Bartramia longicauda, Upland Sandpiper
Numenius phaeopus, Whimbrel
Numenius americanus, Long-billed Curlew
Limosa limosa, Black-tailed Godwit
Limosa haemastica, Hudsonian Godwit
Limosa fedoa, Marbled Godwit
Arenaria interpres, Ruddy Turnstone
Aphriza virgata, Surfbird
Calidris canutus, Red Knot
Calidris alba, Sanderling
Calidris pusilla, Semipalmated Sandpiper
Calidris mauri, Western Sandpiper
Calidris minutilla, Least Sandpiper
Calidris fuscicollis, White-rumped Sandpiper
Calidris bairdii, Baird's Sandpiper
Calidris melanotos, Pectoral Sandpiper
Calidris acuminata, Sharp-tailed Sandpiper
Calidris maritima, Purple Sandpiper
Calidris alpina, Dunlin
Calidris ferruginea, Curlew Sandpiper
Calidris himantopus, Stilt Sandpiper
Tryngites subruficollis, Buff-breasted Sandpiper
Philomachus pugnax, Ruff
Limnodromus griseus, Short-billed Dowitcher
Limnodromus scolopaceus, Long-billed Dowitcher
Gallinago gallinago, Common Snipe
Scolopax minor, American Woodcock
Phalaropus tricolor, Wilson's Phalarope
Phalaropus lobatus, Red-necked Phalarope
Phalaropus fulicaria, Red Phalarope

FAMILY LARIDAE
Stercorarius pomarinus, Pomarine Jaeger
Stercorarius parasiticus, Parasitic Jaeger
Stercorarius longicaudus, Long-tailed Jaeger
Larus atricilla, Laughing Gull
Larus pipixcan, Franklin's Gull
Larus minutus, Little Gull
Larus ridibundus, Common Black-headed Gull
Larus philadelphia, Bonaparte's Gull

Larus delawarensis, Ring-billed Gull
Larus argentatus, Herring Gull
Larus thayeri, Thayer's Gull
Larus fuscus, Lesser Black-backed Gull
Larus hyperboreus, Glaucous Gull
Larus marinus, Great Black-backed Gull
Rissa tridactyla, Black-legged Kittiwake
Xema sabini, Sabine's Gull
Sterna nilotica, Gull-billed Tern
Sterna caspia, Caspian Tern
Sterna maxima, Royal Tern
Sterna sandvicensis, Sandwich Tern
Sterna dougallii, Roseate Tern
Sterna hirundo, Common Tern
Sterna paradisaea, Arctic Tern
Sterna forsteri, Forster's Tern
Sterna antillarum, Least Tern
Sterna anaethetus, Bridled Tern
Sterna fuscata, Sooty Tern
Chlidonias niger, Black Tern
Anous stolidus, Brown Noddy
Anous minutus, Black Noddy
Rynchops niger, Black Skimmer

FAMILY ALCIDAE
Alle alle, Dovekie
Alca torda, Razorbill

ORDER COLUMBIFORMES
FAMILY COLUMBIDAE
Columba squamosa, Scaly-naped Pigeon
Columba leucocephala, White-crowned Pigeon
Columba fasciata, Band-tailed Pigeon
Zenaida asiatica, White-winged Dove
Zenaida aurita, Zenaida Dove
Zenaida macroura, Mourning Dove
Columbina passerina, Common Ground-Dove
Geotrygon chrysia, Key West Quail-Dove
Geotrygon montana, Ruddy Quail-Dove

ORDER CUCULIFORMES
FAMILY CUCULIDAE
Coccyzus erythropthalmus, Black-billed Cuckoo
Coccyzus americanus, Yellow-billed Cuckoo
Coccyzus minor, Mangrove Cuckoo
Crotophaga ani, Smooth-billed Ani
Crotophaga sulcirostris, Groove-billed Ani

ORDER STRIGIFORMES
FAMILY TYTONIDAE
Tyto alba, Common Barn-Owl

FAMILY STRIGIDAE
Otus asio, Eastern Screech-Owl
Bubo virginianus, Great Horned Owl
Athene cunicularia, Burrowing Owl
Strix varia, Barred Owl
Asio otus, Long-eared Owl
Asio flammeus, Short-eared Owl
Aegolius acadicus, Northern Saw-whet Owl

ORDER CAPRIMULGIFORMES
FAMILY CAPRIMULGIDAE
Chordeiles acutipennis, Lesser Nighthawk
Chordeiles minor, Common Nighthawk
Chordeiles gundlacchii, Antillean Nighthawk
Caprimulgus carolinensis, Chuck-will's-widow
Caprimulgus vociferus, Whip-poor-will

ORDER APODIFORMES
FAMILY APODIDAE
Chaetura pelagica, Chimney Swift
Tachornis phoenicobia, Antillean Palm Swift

FAMILY TROCHILIDAE
Amazilia yucatenensis, Buff-bellied Hummingbird
Calliphlox evelynae, Bahama Woodstar
Archilochus colubris, Ruby-throated Hummingbird
Archilochus alexandri, Black-chinned Hummingbird
Selasphorus rufus, Rufous Hummingbird

ORDER CORACIIFORMES
FAMILY ALCEDINIDAE
Ceryle alcyon, Belted Kingfisher

ORDER PICIFORMES
FAMILY PICIDAE
Melanerpes erythrocephalus, Red-headed Woodpecker
Melanerpes carolinus, Red-bellied Woodpecker
Sphyrapicus varius, Yellow-bellied Sapsucker
Picoides pubescens, Downy woodpecker
Picoides villosus, Hairy woodpecker
Picoides borealis, Red-cockaded woodpecker
Colaptes auratus, Northern Flicker
Dryocopus pileatus, Pileated Woodpecker
Campephilus principalis, Ivory-billed Woodpecker

ORDER PASSERIFORMES
FAMILY TYRANNIDAE
Contopus borealis, Olive-sided flycatcher
Contopus virens, Eastern Wood-Pewee
Empidonax flaviventris, Yellow-bellied Flycatcher
Empidonax virescens, Acadian Flycatcher
Empidonax alnorum, Alder Flycatcher
Empidonax traillii, Willow Flycatcher
Empidonax minimus, Least Flycatcher
Sayornis nigricans, Black Phoebe
Sayornis phoebe, Eastern Phoebe
Sayornis saya, Say's Phoebe
Pyrocephalus rubinus, Vermilion Flycatcher
Myiarchus cinerascens, Ash-throated Flycatcher
Myiarchus crinitus, Great Crested Flycatcher
Myiarchus tyrannulus, Brown-crested Flycatcher
Tyrannus vociferans, Cassin's Kingbird

Tyrannus verticalis, Western Kingbird
Tyrannus tyrannus, Eastern Kingbird
Tyrannus dominicensis, Gray Kingbird
Tyrannus caudifasciatus, Loggerhead Kingbird
Tyrannus forficatus, Scissor-tailed Flycatcher
Tyrannus savana, Fork-tailed Flycatcher

FAMILY ALAUDIDAE
Eremophila alpestris, Horned Lark

FAMILY HIRUNDINIDAE
Progne subis, Purple Martin
Tachycineto bicolor, Tree Swallow
Tochycineta cyaneoviridis, Bahama Swallow
Stelgidopteryx serripennis, Northern Rough-winged Swallow
Riparia riparia, Bank Swallow
Hirundo pyrrhonota, Cliff Swallow
Hirundo fulva, Cave Swallow
Hirundo rustica, Barn Swallow

FAMILY CORVIDAE
Cyanocitta cristato, Blue Jay
Aphelocoma coerulescens, Scrub Jay
Corvus brachyrhynchos, American Crow
Corvus ossifragus, Fish Crow

FAMILY PARIDAE
Parus carolinensis, Carolina Chickadee
Porus bicolor, Tufted Titmouse

FAMILY SITTIDAE
Sitta canadensis, Red-breasted Nuthatch
Sitto pusilla, Brown-headed Nuthatch

FAMILY CERTHIIDAE
Certhio americana, Brown Creeper

FAMILY TROGLODYTIDAE
Thryothorus ludovicianus, Carolina Wren
Troglodytes aedon, House Wren
Troglodytes troglodytes, Winter Wren
Cistothorus platensis, Sedge Wren
Cistothorus palustris, Marsh Wren

FAMILY MUSCICAPIDAE
SUBFAMILY SYLVIINAE
Regulus satrapa, Golden-crowned Kinglet
Regulus calendula, Ruby-crowned Kinglet
Polioptila caerulea, Blue-gray Gnatcatcher

SUBFAMILY TURDINAE
Oenanthe oenanthe, Northern Wheatear
Sialis sialis, Eastern Bluebird
Catharus fuscescens, Veery
Catharus minimus, Gray-cheeked Thrush
Catharus ustulotus, Swainson's Thrush
Cotharus guttatus, Hermit Thrush
Hylocichla mustelina, Wood Thrush
Turdus migratorius, American Robin
Ixoreus naevius, Varied Thrush

FAMILY MIMIDAE
Dumetella carolinensis, Gray Catbird
Mimus polyglottos, Northern Mockingbird
Toxostoma rufum, Brown Thrasher

FAMILY MOTACILLIDAE
Anthus spragueii, Sprague's Pipit

FAMILY BOMBYCILLIDAE
Bombycilla cedrorum, Cedar Waxwing

FAMILY LANIIDAE
Lanius ludovicianus, Loggerhead Shrike

FAMILY VIREONIDAE
Vireo griseus, White-eyed Vireo
Vireo bellii, Bells' Vireo
Vireo solitarius, Solitary Vireo
Vireo flavifrons, Yellow-throated Vireo
Vireo gilvus, Warbling Vireo
Vireo philadelphicus, Philadelphia Vireo
Vireo olivaceus, Red-eyed Vireo
Vireo altiloquus, Black-whiskered Vireo

FAMILY EMBERIZIDAE
SUBFAMILY PARULINAE
Vermivora bachmanii, Bachman's Warbler
Vermivora pinus, Blue-winged Warbler
Vermivora chrysoptera, Golden-winged Warbler
Vermivora peregrina, Tennessee Warbler
Vermivora celata, Orange-crowned Warbler
Vermivora ruficapilla, Nashville Warbler
Parula americana, Northern Parula
Dendroica petechia, Yellow Warbler
Dendroica pensylvanica, Chestnut-sided Warbler
Dendroica magnolia, Magnolia Warbler
Dendroica tigrina, Cape May Warbler
Dendroica caerulescens, Black-throated Blue Warbler
Dendroica coronata, Yellow-rumped Warbler
Dendroica nigrescens, Black-throated Gray Warbler
Dendroica townsendi, Townsend's Warbler
Dendroica virens, Black-throated Green Warbler
Dendroica fusca, Blackburnian Warbler
Dendroica dominica, Yellow-throated Warbler
Dendroica pinus, Pine Warbler
Dendroica kirtlandii, Kirtland's Warbler
Dendroica discolor, Prairie Warbler
Dendroica palmarum, Palm Warbler
Dendroica castanea, Bay-breasted Warbler
Dendroica striata, Blackpoll Warbler
Dendroica cerulea, Cerulean Warbler
Mniotilta varia, Black-and-White Warbler
Setophaga ruticilla, American Redstart
Protonotaria citrea, Prothonotary Warbler
Helmitheros vermivorus, Worm-eating Warbler
Limnothlypis swainsonii, Swainson's Warbler
Seiurus aurocapillus, Ovenbird
Seiurus noveboracensis, Northern Waterthrush
Seiurus motacilla, Louisiana Waterthrush

Oporornis formosus, Kentucky Warbler
Oporornis agilis, Connecticut Warbler
Oporornis philadelphia, Mourning Warbler
Geothlypis trichas, Common Yellowthroat
Wilsonia citrina, Hooded Warbler
Wilsonia pusilla, Wilson's Warbler
Wilsonia canadensis, Canada Warbler
Icteria virens, Yellow-breasted Chat

SUBFAMILY THRAUPINAE

Spindalis zena, Stripe-headed Tanager
Piranga rubra, Summer Tanager
Piranga olivacea, Scarlet Tanager
Piranga ludoviciana, Western Tanager

SUBFAMILY CARDINALINAE

Cardinalis cardinals, Northern Cardinal
Pheucticus ludovicianus, Rose-breasted Grosbeak
Pheucticus melanocephalus, Black-headed Grosbeak
Guiraca caerulea, Blue Grosbeak
Passerina amoena, Lazuli Bunting
Passerina cyanea, Indigo Bunting
Passerina ciris, Painted Bunting
Spiza americana, Dickcissel

SUBFAMILY EMBERIZINAE

Pipilo erythrophthalmus, Rufous-sided Towhee
Tiaris bicolor, Black-faced Grassquit
Aimophila aestivalis, Bachman's Sparrow
Spizella passerina, Chipping Sparrow
Spizella pallida, Clay-colored Sparrow
Spizella pusilla, Field Sparrow
Pooecetes gramineus, Vesper Sparrow
Chondestes grammacus, Lark Sparrow
Calamospiza melanocorys, Lark Bunting
Passerculus sandwichensis, Savannah Sparrow
Ammodramus savannarum, Grasshopper Sparrow
Ammodramus henslowii, Henslow's Sparrow
Ammodramus leconteii, Le Conte's Sparrow
Ammodramus caudacutus, Sharp-tailed Sparrow
Ammodramus maritimus, Seaside Sparrow
Melospiza melodia, Song Sparrow
Melospiza lincolnii, Lincoln's Sparrow
Melospiza georgiana, Swamp Sparrow
Zonotrichia albicollis, White-throated Sparrow
Zonotrichia leucophrys, White-crowned Sparrow
Zonotrichia querula, Harris' Sparrow
Junco hyemalis, Dark-eyed Junco
Calcarius lapponicus, Lapland Longspur

SUBFAMILY ICTERINAE

Dolichonyx oryzivorus, Bobolink
Agelaius phoeniceus, Red-winged Blackbird
Sturnella magna, Eastern Meadowlark
Sturnella neglecta, Western Meadowlark
Xanthocephalus xanthocephalus, Yellow-headed Blackbird
Euphagus carolinus, Rusty Blackbird
Euphagus cyanocephalus, Brewer's Blackbird
Quiscalus major, Boat-tailed Grackle
Quiscalus quiscula, Common Grackle
Molothrus bonariensis, Shiny Cowbird
Molothrus aeneus, Bronzed Cowbird
Molothrus ater, Brown-headed Cowbird
Icterus spurius, Orchard Oriole
Icterus galbula, Northern Oriole

FAMILY FRINGILLIDAE
SUBFAMILY CARDUELINAE

Carpodacus purpureus, Purple Finch
Carduelis pinus, Pine Siskin
Carduelis tristis, American Goldfinch

Florida Fish and Wildlife Conservation Commission

James L. "Jamie" Adams, Jr.
Bushnell
Barbara C. Barsh
Jacksonville
Quinton L. Hedgepeth, DDS
Miami
H.A. "Herky" Huffman
Deltona
Thomas B. Kibler
Lakeland
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Miami
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Pensacola
John D. Rood
Jacksonville

ALLAN L. EGBERT, Ph.D., Executive Director
VICTOR J. HELLER, Assistant Executive Director

OFFICE OF ENVIRONMENTAL SERVICES
BRADLEY J. HARTMAN, DIRECTOR
620 South Meridian Street
Tallahassee, FL 32399-1600
www.state.fl.us/fwc
(850)488-6661
FAX (850)922-5679
TDD (850)488-9542

November 16, 1999

Ms. Margaret L. DeLaura
Community Planner
National Park Service
P.O. Box 25287
Denver Colorado 80225-0287

RE: EVER 05 02
Dry Tortugas National Park
General Management Plan/EIS

Dear Ms. DeLaura:

Thank you for your request regarding a list of endangered, threatened and species of special concern that occurs within or adjacent to the Dry Tortugas National Park. Enclosed is a list of species with their state and federal status that may be found in or adjacent to Dry Tortugas area. Aside for the listed species, the sooty tern and the magnificent frigate birds are known to nest in the Dry Tortugas.

If you have any questions or need further information you can contact me in writing at 2796 Overseas Highway Suite 213, Marathon FL 33050 or by phone at (305)289-2365.

Sincerely,

Rowena P. Garcia

Enclosure

ENV 8-4-1

Table 1. Status of and major threats to endangered and potentially endangered vertebrates and invertebrates in the Florida Keys.

Taxon / Common Name	Scientific Name	State Status	Federal Status
Fish			
Common snook	*Centropomus undecimalis*	SSC	
Amphibians and reptiles			
Atlantic loggerhead turtle	*Caretta caretta caretta*	T	T
Atlantic green turtle	*Chelonia mydas mydas*	E	E
Leatherback turtle	*Dermochelys coriacea*	E	E
Atlantic hawksbill turtle	*Eretmochelys imbricata imbricata*	E	E
Florida Keys mole skink	*Eumeces egregius egregius*	SSC	
Key mud turtle	*Kinosternon bauri bauri*	E	
Atlantic ridley turtle	*Lepidochelys kempi*	E	E
Birds			
Roseate spoonbill	*Ajaia ajaja*	SSC	
Southeastern snowy plover	*Charadrius alexandrinus tenuirostric*	T	
Piping plover	*Charadrius melodus*	T	UR1
White-crowned pigeon	*Columba leucocephala*	T	
Little blue heron	*Egretta caerulea*	SSC	
Reddish egret	*Egretta rufescens*	SSC	
Snowy egret	*Egretta thula*	SSC	
Tricolored heron	*Egretta tricolor*	SSC	
Southeastern American kestrel	*Falco sparverius paulus*	T	
Arctic peregrine falcon	*Falco peregrinus tundrius*	E	T
Bald eagle	*Haliaeetus leucocephalus*	T	E
Wood stork	*Mycteria americana*	E	E

Brown pelican	*Pelecanus occidentalis*	SSC	
Least tern	*Sterna antillarum*	T	
Roseate tern	*Sterna dougallii*	T	
Black skimmer	*Rynchops niger*	SSC	
Osprey	*Pandion haliaetus*	SSC	
White ibis	*Eudocimus albus*	SSC	
Mammals			
West Indian manatee	*Trichechus manatus latirostris*	E	E
Finback whale	*Balaenoptera physalus*	E	E
Humpback whale	*Megaptera novaeangliae*	E	E
Invertebrates[c]			
Pillar coral	*Dendrogyra cylindrus*	E	E

[a] E = endangered; T = threatened; T(S/A) = threatened due to similarity of appearance; SSC = species of special concern; UR1 = under review for federal listing with substantial evidence indicating at least some degree of biological vulnerability and/or threat; = under review for federal listing but substantial evidence of biological vulnerability and/or threat is lacking. Note: an asterisk indicates that the listing only is applicable to the Lower Keys.

[c] Excludes corals.

APPENDIX I: METHODS FOR ASSESSING IMPACTS ON NATURAL RESOURCES

MAPPING ANALYSIS

Each of the management alternatives encompasses different areas and/or visitor use and access levels for the four management zones. A first step in evaluating the natural resource impacts of each alternative plan is to analyze the amount of area set aside for protection in conjunction with visitor carrying capacities (see appendix D, table D-1). The total area of each underwater habitat type by depth category is listed in table A2b (appendix G). Proportions of underwater habitat areas within research natural area zones are given in table A2c (appendix G).

One of the most important indicators of the health of the coral reef system is the diversity of the reef fish community. Diversity measures of all fishes and of the snapper-grouper-grunt complex, both within the park and for the entire Tortugas region, are given in table A6. The proportions of diversity protected by various research natural area zones are also given. Sustaining greater diversity of the reef fish community provides for a more pristine environment and greater attractiveness for viewing by visitors.

The sampling effort conducted during 1999 provides a good baseline understanding of reef fish spatial abundance and size patterns in the park. Statistical models were developed to describe relationships between species density and length distributions and habitat (Meester 2000). Average fish densities (numbers per unit area) within habitat types were multiplied by habitat areas to estimate spatial abundance for a given species. These spatial abundance maps were used as initial population values in the simulation model described below.

Spatial Population Simulation Model

The testing of alternative management plans with respect to fishing impacts for Dry Tortugas National Park requires the use of a spatially and temporally dynamic population simulation model. If spatial dynamics are not accounted for, the effective exploration of spatial and/or temporal alternatives is not allowed (Pelletier and Magal 1996). The model was designed and built in the C++ programming language to take advantage of its object-oriented capabilities. The resulting model is called the STOCaST (Spatial and Temporal Object-oriented Cohort-STructured) model, and is spatially composed of the subunit grid structure described in Meester (2000). The population is composed of a length- and time-based cohort structure. The model incorporates functions for growth, aging, natural mortality, fishing mortality, fecundity (egg production), and animal movements.

The STOCaST model was used to simulate the impact of implementing the management alternatives on the snapper, grouper, and grunt reef fish populations (as well as hogfish) from Key West out to the Dry Tortugas (including the park and the Dry Tortugas Bank and Riley's Hump). These families of reef fish were chosen because they are the most sought-after reef fish by both the recreational and commercial fisheries. A total of 19 species were simulated, including groupers (rock hind, graysby, coney, red hind, black, scamp, yellowfin, yellowmouth, and red); snappers (mutton, gray, dog, lane, and yellowtail); and grunts (margate, tomtate, white, bluestriped; and hogfish). The population parameters for each of these species are taken from Ault et al. (1998) and Meester (2000).

The model was run 20 years into the future for each alternative to access the impact of implementing each alternative on spawning stock biomass (SSB), yield in weight, and egg production of the stocks. Spawning stock biomass is the biomass of all reproductively viable individuals in a stock, and egg production is the number of eggs produced by a stock in a year. The yield in weight is the total weight of the catch taken by the fishing activity. STOCaST assumes no stock-recruitment relationship, and therefore the results shown are to be considered minimal responses to the impact of implementing research natural area zones. Not enough is known about the true form of the stock-recruitment relationship for reef fish, and the inclusion of such a relationship in the model may produce overly optimistic results, depending on the form of the relationship chosen.

The results are shown in figures B7, B9, and B11 in the "Impacts on Natural Resources" section and allow for the evaluation of each alternative as to its impacts on the maintenance of sustainable reef fish stocks under exploitation and to the fishing activity operating in the Dry Tortugas region. The results are shown for the options described in figure B5 (appendix G), which shows the spatial extents and boundaries of NPS research natural areas and the sanctuary's ecological reserves for alternatives C, D, and E. and for alternative C without the sanctuary's reserve (alternative C1), which is not an alternative that is discussed in this document. Simulations of alternative plans that establish research natural areas (alternatives C, D, and

E) presume that the research natural area would be implemented in conjunction with the Florida Keys National Marine Sanctuary marine reserves in the adjacent waters of the Tortugas region. It is important to realize that the use of spatial closures (marine reserves, research natural areas, etc.) will not produce immediate results and will vary significantly by species according to the level of fishing pressure exerted on each and each species' movement characteristics and life span. Significant changes in population size and structure should be recognizable at approximately half the time of the species life span, and the results presented here are to be expected at one year less than the species life span. The endpoints (spawning stock biomass, yield in weight, and egg production) of the simulations are shown as a relative measure compared to alternative A, the status quo, which receives a value of 1.00. The fish are assumed to move in large home ranges, allowing for fish to cross boundaries between zones on a daily basis. Equilibrium conditions, which occur at one year past the life span of each species, are reached, and show what the comparative impacts of each alternative will be on the reef fish stock of interest.

Analytical Hierarchy Process (AHP) Model

The analytical hierarchy process (AHP) model is a method of breaking down a complex, unstructured situation into its component parts (Saaty 1986). These parts, or variables, are arranged into a hierarchical order, assigned numerical values using subjective judgments on the relative importance of each variable, and synthesized to determine which variables have the highest priorities and should be acted upon to influence the outcome of the situation (Saaty et al. 1994). AHP procedures allow resource managers to structure and execute hundreds of quantitative and qualitative assessments simultaneously to evaluate alternatives and rapidly calculate summary values (Schmoldt et al. 1994, Golden et al. 1989)). The analysis as to which management alternative provides the best protection for the park's resources is structured as an AHP model and analyzed using the Expert Choice decision support software (Forman and Saaty 1999).

The model is set up to determine the best alternative for meeting the park's objectives of sustaining a near-pristine environment. This is achieved by establishing a goal that the AHP model seeks to optimize with the following subcriteria: (1) maintain and protect natural ecological processes; (2) minimize human impacts; (3) establish monitoring system; and (4) provide management and research direction. This goal is assessed by determining the impact of each management alternative on criteria within four major categories: (1) essential and unique habitats, (2) fisheries resources, (3) wildlife, and (4) environmental setting. See table A4 for all criteria assessed within each of these four categories. Each of these criteria may be impacted by a variety of invasive human uses (table A5), and several matrices are established that describe the impact of each invasive use on each criterion. Multiplying these matrices provides the relative risk associated with each use and the framework for determining long-term impacts on the resources of the park. The AHP model framework is given in table A7.

The hierarchical structure employed in this approach is flexible and can be modified to incorporate dynamic circumstances or opinions of differing experts. Comparative analyses were guided by information from the literature and ongoing studies, integrating the primary factors reflecting environmental impact, and allowing the ranking of various policy alternatives. The overall model results are shown in figure B13. Sensitivity analyses (performance-type) were employed to evaluate the effects of differing weighting schemes upon model outcomes. These analytic processes are iterative. The model structures, data matrices, and their decision outcomes will evolve with increasing insight into the complex biological and socioeconomic attributes of the park's system.

Table A6: Percent of Reef Fish Diversity (Total Fishes and Fishes in the Snapper-Grouper-Grunt Complex) Protected by a Research Natural Area Zone for Different Management Alternatives. Tortugas region values for alternatives D and E presume that the research natural area zone within the park would be implemented in conjunction with an research natural area/ecological reserve for the Florida Keys National Marine Sanctuary's surrounding waters.

	Total Number of Species	Case 1: Alternatives A & B	Case 2: Alternative C without a sanctuary ecological reserve	Case 3: Alternative C with a sanctuary ecological reserve	Case 4: Alternative D	Case 5: Alternative E
Reef Fish Community						
Tortugas region	194	0.0	63.9	83.0	81.4	87.6
Park only	141	0.0	87.9	87.9	80.1	100.0
Snapper-Grouper-Grunt						
Tortugas region	35	0.0	77.1	94.3	82.9	94.3
Park only	28	0.0	96.4	96.4	78.6	100.0

Table A4: Summary of the Park's Affected Natural Resources

(1) Essential and Unique Habitats corals and coral reefs, hardbottoms, sea grasses, sand islands	**(2) Fishery Resources** exploited reef fish (snapper-grouper-grunt complex), exploited macroinvertebrates, unexploited reef resources, sharks and rays, pelagic species, baitfish, protected/endangered species
(3) Wildlife Resources nesting birds, other migratory birds, sea turtles, marine mammals	**(4) Environmental Setting** Soundscape, night-time lighting, water quality/pollution

Table A5: Summary of Invasive Human Uses That Might Impact Park's Natural Resources

Boating Groundings (contact damage, fuel spills, etc.) and propeller damage Anchoring Sewage and trash dumping, fuel leaks Scuba diving, snorkeling, swimming Fishing	Hiking, walking Camping, picnicking Wildlife watching, photography (from land, sea or air) Seaplanes, aircraft Facilities, lighting

Table A7: AHP Model Structure for the Park's Affected Natural Resources

GOAL: **Define a preferred alternative for the national park**
(1) maintain and protect natural ecological processes
(2) minimize human impacts.
(3) establish monitoring system and identify threats.
(4) provide management and research direction.

CRITERIA:	Natural Resource Conditions:	Symbol	Level 2 Sub-Criteria:	Symbol
(1) Fishery Resources:		**fishery**		
	(a) exploited groupers	groupers	(1a) spawning stock biomass	ssb
	(b) exploited snappers	snappers	(1b) yield in weight	Y_w
	(c) exploited grunts	grunts	(1c) stock egg production	eggs
	(d) exploited macroinvertebrates (shrimp, lobster, conch)	exp_mi	(1d) average size	Lbar
	(e) unexploited reef fish resources (herbivores-butterflyfish, damselfish, invertebrates, etc.)	unexp_rf		
	(f) sharks and rays	sharks		
	(g) pelagics (kingfish, mackerel, dolphinfish, billfish, tunas, etc.)	exp_pel		
	(h) baitfish	baitfish		
	(i) exceptional and protected resources (e.g., jewfish)	protect		
(2) Essential & Unique Habitats:		**habitats**		
	(a) corals and coral reefs (gorgonions, sponges)	corals	(2a) percent cover and abundance	%cover
	(b) hardbottoms (soft corals, sponges and algae)	hardbot	(2c) diversity	diversit
	(c) seagrasses	seagrass		
	(d) sand	sand		
	(e) islands (7 of coral and sand)	islands		
(3) Wildlife Resources:		**wildlife**		
	(a) nesting birds (sooty and noddy terns, frigate birds)	birds_ne	(3a) nests and pairs	nests
	(b) other migratory birds	birds_mi	(3b) animal abundance	abund
	(c) marine turtles (green and loggerhead turtles)	turtles		
	(d) marine mammals	mar_mam		
	(g) exceptional resources (e.g., Loggerhead Forest)	wild_er		
	(h) endangered/threatened resources	wild_end		
(4) Other Natural Environments:		**environs**		
	(a) Natural Soundscape:	sound		
	(b) Night-time Lighting:	lights		
	(c) Water Quality:	wq		

APPENDIX J: SUBMERGED CULTURAL RESOURCES STRATEGY

This submerged cultural resources strategy reflects basic tenets fundamental to submerged cultural resources management. It has been developed to specifically elaborate NPS policies and guidelines regarding all cultural resources for application to Dry Tortugas National Park submerged resources, which are the majority of park cultural resources. Sound management of submerged lands in the National Park Service requires adequate scholarly and scientific knowledge about resources. This strategy was developed from a scientific perspective reflecting the tradition of scholarly research identified in the park's enabling legislation and its application in the development of NPS management decisions (as mandated in the Omnibus Act of 1998). Incorporated into this strategy is the perspective that effective management of submerged lands requires concurrent consideration of natural and cultural resources for inventory, monitoring, research, interpretation, education, and protection activities conducted within the park.

I. Cultural Resource Inventory Program

Although there is a small potential for inundated prehistoric terrestrial sites, most of the submerged sites within Dry Tortugas National Park (DRTO) are historic. The current park boundary contains more than 275 historically documented maritime casualties, (shipwrecks, groundings and strandings), some from as early as the sixteenth century, and human activity there has left an equally long material record. Many other maritime casualties lie immediately to the west of the current park boundary on Tortugas Banks. Archeological sites of Dry Tortugas National Park and the Tortugas Banks share a common ecosystem and maritime history that provide the context for interpretation of archeological remains. The sites of both areas must be studied within the same context to properly interpret the archeological record contained in each component.

Lands outside DRTO are managed by the National Oceanic and Atmospheric Agency (NOAA) and the State of Florida. Every effort will be made to enhance interagency cooperation and partnership so that the submerged resources and associated values of Tortugas Banks are afforded at least the same level of protection, preservation and study as those within DRTO.

Systematic inventory of submerged lands within DRTO has been conducted annually from 1993–1997 by the NPS Submerged Resources Center (SRC), formerly Submerged Cultural Resources Unit. Currently more than 90% of navigable areas in the park shallower than 10m has been surveyed with remote sensing equipment directed toward location of cultural remains. A portion of this area, primarily South Loggerhead Reef has been investigated and documented archeologically. This area has also been surveyed using remote sensing equipment that characterizes natural resources on the seabed, which has demonstrated the cost-effectiveness of a combined natural and cultural survey approach. The survey was conducted in part to develop and refine a model methodology for application to other NPS submerged areas.

Although most of the 10m or shallower priority area has been surveyed and the presence of cultural remains indicated, only a portion of surveyed area has been archeologically documented and evaluated for significance. Very little area deeper than 10m has been surveyed.

The long-term goal of 100% survey of all submerged lands and evaluation of all archeological materials within the park can be met in a stepped approach designed to cover high-potential areas and provide interim information for management decisions.

Immediate goal is to complete 100% remote sensing survey of all navigable areas shallower than 30 feet (10m) following the model developed during the 1993–1997 survey. This model can serve as minimum acceptable standards. Priority consideration should be given to combining seabed classification with the cultural resource remote sensing survey. Data will be added to the cumulative Geographic Information System (GIS) developed during the SRC survey known as the DRTO Survey GIS Database and to the NPS Archeological Sites Information Management System (ASMIS) and appropriate natural resource databases.

Intermediate goal is to conduct 20% random sample remote sensing survey of areas within the park deeper than 30 feet to characterize nature and extent of cultural resources in this area. Completion of this task will aid planning for additional survey to complete 100% coverage.

Although magnetic anomalies located by remote sensing survey indicate presence of cultural materials, they should be archeologically evaluated to determine their nature and significance as soon as possible, ideally concurrent with remote sensing operations. Anomalies that are not investigated are not included in the park's archeological site inventory, however, prior to investigation they can be considered as potentially significant archeological areas for management purposes. Anomaly areas must be dived to determine whether ferrous materials are buried. If exposed, minimal documentation, which includes precise location, written description, video and photography, should be conducted and analyzed for potential significance and added to the DRTO Survey GIS Database and ASMIS. Systematic test excavation to evaluate buried anomalies should be second priority to documentation of exposed remains, although it should be conducted as soon as practical.

Full evaluation and documentation of sites determined potentially significant relative to the National Register for Historic Places criteria will be completed as areas are archeologically evaluated. An appropriate multiproperty National Register nomination will be completed. This nomination may be either a thematic, district or perhaps cultural landscape nomination. DRTO, ideally combined with Tortugas Banks, because of its many properties of potential national and international significance, should be evaluated for eligibility as a World Heritage Site upon acceptance of the multi-property National Register nomination.

II. Monitoring

Knowing resource condition and how it changes on a continuing basis is fundamental to the park's ability to manage its resources and perpetuate their integrity. A comprehensive monitoring plan, to which both natural and cultural specialists will contribute, will be developed tested and implemented. The proposed program will embrace a holistic approach, which includes both natural and cultural aspects so far as practical in a single set of protocols. The objective is to understand the nature and present condition of resources and how and why they change so as to direct management decisions and evaluate their success or failure.

Initially, identification of appropriate criteria such as integrity, potential significance, accessibility, and vulnerability will be developed to aid in establishing priorities for inclusion in the program on a site by site basis. Then, procedures will be developed that will minimally provide an index detailing which attributes will be monitored, set parameters for management decisions, and define which data will be collected for longitudinal study and evaluation.

The monitoring program will contain at least three principal components:

1) Annual basic site assessment of the sites prioritized by the criteria;
2) Event-driven assessments of impact from storms, hurricanes, vessel groundings, divers, ARPA violations, etc.;
3) Long-term detailed assessments to monitor site dynamics. Sites for this component will be selected upon the completion of the remote sensing survey and site evaluation of the current Inventory Program (section I).

The monitoring results can trigger a full multi-disciplinary site impact investigation based on specific indicators of changing site conditions. These indicators, developed as part of the monitoring program, may be site specific.

The monitoring program will be multidisciplinary, including both natural and cultural resource assessment components (e.g., coral growth rates and distribution). It will incorporate comprehensive baseline data and produce cumulative results. All data will be accessible in the DRTO Survey GIS Database and ASMIS and natural resource databases as appropriate.

III. Research

Research conducted within DRTO that contributes significantly to knowledge about park resources and is directed toward park management objectives will be promoted. Research will conform to the NPS Cultural Resource's Management Handbook and the Secretary of Interior's Standards and Guidelines in addition to regional and park specific policies.

All research conducted on archeological resources must be done under an approved research proposal and either a NPS Research permit or an Archeological Resources Protection Act permit. Activities having an affect or potential to affect cultural resources are governed by the National Environmental Policy (NEPA), the National Historic Preservation Act (NHPA), the Archeological Resources Protection Act (ARPA) and Antiquities Act of 1906 (AA).

The park research coordinator must receive proposals in written and electronic format. The proposal should consist of a clear purpose statement discussing the proposed research, research design and the relevance of the research to park goals, regional archeology and the mission of the NPS. In addition, the proposal should present discussions on theoretical frameworks and methodology and include a discussion on potential site impact that includes consideration of both natural and cultural effects. Proposals that incorporate sediment disturbance, collection of materials or any intervention must include compelling evidence as to why the proposed research is essential to significant research concerns and that the purpose of the research can only be achieved by utilizing park resources. A clear statement discussing requests for NPS support is to be presented. Any cooperative agreement, memoranda of understanding or memoranda of agreement should be established prior to proposal submission. Specific research products and a timetable for their submission and a vitae of the principal investigator (along with vita for senior project participants) should accompany proposals.

All student training, field schools and education-oriented research will be completely nondestructive, nonimpact and nonintrusive to both natural and cultural resources. Access will focus on sites already fully documented and results will be incorporated into the monitoring program (outlined in section II).

Review and evaluation of research proposals will follow standard NPS procedures. In addition, the park will request review by appropriate park scientific and management personnel, Southeast Archeological Center (SEAC), SRC, and two appropriate academic peer reviewers (one of which may be suggested by the researcher submitting the proposal). Upon proposal approval, specific permitting conditions will be specified. In addition to standard permitting conditions that detail data dissemination, a park-specific condition requires all electronically accessible data meet ASMIS and DRTO Survey GIS Database standards and format. The park and SEAC will receive copies of all original data, written, graphic and electronic, and publications that directly or indirectly result from research conducted under the proposal or permit. All field data, objects, specimens, samples, features and structures retrieved, along with associated records and reports will be managed within the park's museum collection.

For projects that entail no collections or intervention, a research permit will be issued. Projects impacting cultural resources (through sample and artifact collection, excavation, or any ground disturbing activities or other intervention) will require an ARPA/AA permit. The Southeast Regional Director signs all park ARPA permits.

If the research proposal is denied, the research coordinator may provide comments and suggestions for the principal investigator to incorporate into a revised research design.

The park research coordinator will determine the extent to which fieldwork will be monitored. The monitoring protocol will vary on a project-by-project basis according to planned activities.

If research is proposed within the boundaries of DRTO and in non-park service areas (such as areas under the jurisdiction of NOAA, other federal agencies, or the state of Florida), the agencies involved will coordinate review and evaluation of the proposal and collectively develop a monitoring program. The principal submitting the proposal is responsible for compliance with all agency-specific requirements.

IV. Education/Interpretation

Visitors and others interested in the submerged cultural resources of DRTO will be provided with access to high quality interpretation and opportunities to enhance appreciation of the specific archeological and historical values of the park's cultural resources in a wide historical context. The park will develop a list of sites that will be identified and interpreted to the public. Other cultural sites will not be identified to the public. Listed sites will have complete documentation and monitoring program in place. The exceptions are sites currently identified to the public. These sites should be priority for development of the monitoring program. Currently listed sites, for example the "Windjammer Site" and the "East Key Site" (both listed in the park brochure) should be priority for developing the monitoring program and as such serve as test cases for monitoring.

Additional sites that may be appropriate for opening to public access and interpretation will be considered. These sites should be fully evaluated for impact to the site and surrounding natural resources, and a monitoring program should be in place prior to identifying to the public.

Alternatives to direct access to submerged cultural and natural resources, such as through video, virtual environment and Internet technology will be developed. Specific considerations will be given to enhancing access and experience to the non-diving public and producing interpretive products accessible to all levels of education that emphasize NPS goals and mission, site preservation and the cultural diversity of DRTO's maritime history.

The park will also develop an integrated regional interpretive approach to maritime history as represented by the archeological record within the natural environment of DRTO, Biscayne National Park, the Florida Keys National Marine Sanctuary and Florida parks. The park will develop formal partnerships where appropriate to enhance a regional approach to archeological investigations and public interpretation of their results.

V. Protection

Protection of natural and cultural resources is a park priority. Protection extends to the associated values of these resources in the broader ecosystem and cultural context. Specific enforcement protocols will be developed for archeologically sensitive areas. The park will consult with SEAC to develop a standardized ARPA response capability and procedures. The park will develop, evaluate and institute remote-sensing surveillance devices to enhance law enforcement efficiency. The park will also develop park-specific submerged cultural resource law enforcement training for park rangers that will be incorporated into law enforcement priorities and park patrol procedures. The park protection program will revise and institute appropriate partnerships with other agencies, organizations and individuals to enhance resource protection capabilities and effectiveness.

Scuba diving is encouraged in the park. The park will investigate and evaluate a permit system for scuba diving and determine whether it is a desirable management alternative. The park will encourage diving only in archeologically surveyed and evaluated areas and direct divers away from archeologically sensitive areas, where moorings are present or boat anchoring is allowed. Mooring buoys directing diving to specific natural resource locations will be placed so as to protect archeological sites in the vicinity. Buoys placed for access to archeological sites will be placed so as to protect natural resources in the vicinity.

Security of site location data in the park is to be maintained. The park will work to develop computer security procedures for access to site-specific data contained in the DRTO Survey GIS Database by appropriate personnel while ensuring site-location data security. Specific site-location data shall be treated as secure information regardless of source, whether electronic or analog, unless clearly already in the public domain.

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PREPARERS AND CONSULTANTS

NPS PREPARERS

Linda Dahl, Job Captain, Everglades and Dry Tortugas National Parks, former Section Leader for Community Planning, Denver Service Center
John Hoesterey, Project Manager, Denver Service Center
Margaret DeLaura, Community Planner, Denver Service Center
Laurie Domler, Community Planner, formerly Denver Service Center
Terry Goodrich, Chief of Planning, Washington Office Concessions Program Center
Miki Stuebe, Landscape Architect, formerly Denver Service Center
Steve Whissen, Cultural Resource Specialist, Denver Service Center
Sarah Bransom, former Section Leader for Natural Resources, Denver Service Center
Christy Fischer, Writer/Editor, Denver Service Center
Dave Kreger, Natural Resource Specialist, Denver Service Center
Frank Willis, Cultural Resource Specialist, Denver Service Center
Larry Murphy, Chief of Submerged Resources Center, Santa Fe, New Mexico
Brenda Lazendorf, Associate Science Coordinator, Submerged Resources Center, Santa Fe, New Mexico

Everglades/Dry Tortugas National Parks
Dick Ring, Superintendent
Larry Belli. Deputy Superintendent
Brien Culhane, Chief, Ecosystem Planning and Compliance
Robert Brock, Supervisory Marine Biologist
Skip Snow, Wildlife Biologist
Bob Johnson, Director, South Florida Natural Resource Center
Reed Detring, fomer Chief, Visitor Protection and Resource Management
Paul Stoehr, Chief, Facilities Management
Neal DeJong, former Chief, Interpretation
Roberta D'Amico, former Chief, Interpretation

Florida Keys National Marine Sancturary
Billy Causey, Superintendent
Ben Haskell, Research Coordinator
Joanne Delaney, Research Interpreter

CONSULTANTS

Warren Brown, Program Manager, Park Planning and Special Studies, NPS Washington Office
Stuart Johnson, Chief of Planning, NPS Southeast Regional Office
University of Miami, Rosenstiel School of Marine and Atmospheric Science
  Jerald S. Ault
  Geoffrey A. Meester
  Jiangang Luo
  Steven G. Smith
  Kenyon C. Lindeman
Gary Davis, Senior Scientist, Channel Islands National Park
Dr. Bill Robertson, Research Biologist, Everglades National Park
Tom Schmidt, Marine Biologist, Everglades National Park

INDEX

Activa 54, 157, 159
Broward County 148, 149, 150, 151
commercial use authorization (CUA) 32, 57, 60, 64, 71, 73, 79, 81, 88, 95, 100, 115, 152, 153, 154, 218, 219, 221, 222, 224-25, 228, 229, 231, 233, 235, 236
concession contract 32, 33, 78, 79, 87, 88, 95, 100, 117, 152, 153, 220, 229, 231, 233
coral 5, 6, 7, 10, 13, 15, 17, 20, 25, 27, 34, 39, 40, 41, 43, 44, 47, 50, 51, 53, 57, 59, 64, 70, 73, 77, 85, 86, 92, 104, 108, 124, 125, 127, 129, 133, 138, 139, 140, 141, 144, 146, 149, 156, 158, 165, 166, 167, 168, 169, 171, 174, 177, 185, 186, 187, 188, 189, 205, 206, 207, 209, 210, 212, 213, 214, 237, 238, 239, 240, 241
CUA *See* commercial use authorization
Dade County 148, 149, 150, 151
Dry Tortugas National Park 5, 6, 10, 12, 13, 14, 16, 17, 25, 27, 32, 54, 70, 118, 124, 133, 137, 138, 148, 151, 153, 155, 165, 237
ecological reserve 25, 35, 54, 72, 81, 90, 98, 165, 172, 177, 179, 181, 183, 209, 212, 215, 222-23, 225
endangered species *See* threatened, rare, and endangered species
Everglades National Park 27, 60, 71, 124, 146, 149, 152, 226
ferry 78, 79, 87, 88, 102, 146, 147, 158, 159, 203, 206, 208, 211, 214, 219, 220, 221, 229
fishery/fisheries 7, 13, 25, 35, 36, 59, 77, 79, 87, 88, 106, 108, 120, 124, 133, 157, 165, 166, 168, 169, 171, 172, 174, 189, 190
Florida Keys National Marine Sanctuary 25, 26, 53, 54, 72, 81, 90, 98, 99, 118, 120, 124, 133, 138, 149, 165, 172, 177, 179, 181, 183, 186, 188, 190, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 222, 223, 225, 237
Fort Jefferson 5, 6, 7, 10, 11, 13, 19, 20, 34, 53, 54, 57, 74, 85, 91, 98, 113, 137, 140, 141, 142, 143, 144, 146, 155, 159, 193, 194, 195, 196, 197, 198, 199, 200, 201, 203, 205, 208, 211, 214
Garden Key 6, 10, 32, 42, 44, 45, 48, 53, 54, 57, 59, 64, 70, 71, 73, 79, 82, 85, 88, 89, 90, 95, 98, 100, 101, 102, 111, 113, 133, 137, 142, 143, 144, 146, 154, 155, 156, 157, 158, 159, 160, 185, 187, 189, 194, 195, 197, 198, 200, 203, 204, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 227, 229, 231, 235, 236
incidental business permit 33, 152, 267
Key West 6, 23, 24, 53, 54, 57, 59, 70, 73, 79, 81, 85, 89, 91, 97, 98, 99, 113, 115, 124, 138, 146, 148, 149, 151, 154, 157, 159, 166, 168, 203, 205, 206, 207, 208, 209, 211, 212, 214, 215, 218, 219, 220, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 243, 244
Loggerhead Key 6, 10, 11, 12, 19, 32, 34, 40, 45, 53, 54, 91, 98, 137, 141, 144, 146, 155, 156, 157, 158, 159, 193, 194, 195, 197, 199, 201, 247
marine mammals 110, 124, 137, 170, 172, 173, 185, 187, 189
marine protected area 35, 165
monitoring 14, 17, 18, 20, 22, 25, 35, 41, 46, 49, 51, 53, 59, 60, 70, 71, 77, 79, 80, 86, 87, 88, 89, 91, 95, 98, 102, 106, 118, 137, 138, 141, 152, 153, 155, 157, 172, 190, 191, 193, 194, 196, 198, 200, 206, 207, 208, 211, 226, 227, 228, 229, 230, 231, 232, 233, 234, 237, 243, 244
Monroe 6, 23, 24, 27, 136, 148, 149, 150, 151, 210, 217, 218, 219, 220, 223, 224
mooring buoy 14, 40, 48, 63, 64, 70, 74, 77, 78, 81, 86, 87, 90, 92, 95, 117, 141, 157, 167, 168, 177, 186, 188, 228, 229, 230, 231, 232, 233, 234, 235, 236, 238, 239
permit/permit system 14, 17, 22, 28, 33, 40, 43, 46, 59, 60, 72, 73, 74, 79, 81, 82, 85, 86, 88, 90, 100, 102, 113, 152, 153, 154, 158, 196, 198, 199, 208, 209, 211, 212, 215, 221, 231, 232
permit system *See* permit
rare *See* threatened, rare, and endangered species
recreational fishermen 113, 178, 187, 189, 207, 209, 210, 212, 213, 215, 220, 222, 223
recreational fishing 13, 28, 38, 39, 53, 64, 73, 82, 90, 100, 113, 115, 118, 158, 159, 202, 207, 209, 210, 212, 213, 215, 216, 220, 222, 223, 224, 225, 235, 236
research natural area 17, 28, 32, 34, 35, 36, 37, 39, 40, 72, 73, 74, 77, 78, 79, 81, 85, 86, 87, 88, 90, 91, 95, 100, 101, 102, 104, 106, 108, 109, 110, 111, 113, 115, 120, 165, 167, 169, 172, 173, 174, 177, 178, 185, 186, 187, 188, 189, 190, 191, 196, 197, 199, 200, 202, 207, 209, 210, 211, 212, 220, 221, 222, 223, 224, 229, 230, 231, 234, 235, 236, 237, 238, 239, 240, 243, 244
seaplane 7, 78, 87, 115, 143, 146, 147, 154, 208, 211, 214, 220, 222, 224, 225
South Florida Ecosystem Restoration Task Force 26, 205, 206, 207, 209, 210, 211, 213, 214, 215
submerged cultural resources 10, 11, 19, 34, 40, 44, 74, 85, 118, 119, 158, 196, 197, 198, 199, 234, 235
threatened, rare, and endangered species 7, 10, 11, 17, 18, 34, 35, 40, 54, 106, 108, 118, 125, 136, 137, 157, 169, 173, 185, 187, 189, 238, 239, 240
turtle 7, 40, 48, 50, 97, 109, 110, 136, 165, 170, 174, 185, 187, 188, 189, 190, 238, 239, 240
U.S. Coral Reef Task Force 17, 25
wetlands 18, 111, 137, 171, 173, 185, 187, 189,
Windjammer, 141, 159

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